

STATEMENT OF WORK
FOR THE NOAA-K, L, M, N, AND N-prime
SATELLITES

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Issued November 1994 for KLMNN-prime

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

REVISION HISTORY

MOD No.	DATE	SECTION(S)
KLM Contract Award	07/26/88	Initial Release
17	09/18/89	11.7
32	07/06/90	4.3
35	08/23/90	8.1
36	08/30/90	10.7.1.1
42	02/01/91	15
46	03/07/91	12
50	04/19/91	10.7.1
52	06/21/91	12 (Cancels Mod 46)
56	08/29/91	12
60	09/16/91	10.7.1
76	08/27/92	12
77	09/11/92	7.5
81	01/28/93	12.6.4.2
83	02/26/93	7.10
84	03/05/93	7.5
86	03/12/93	7.6
87	06/04/93	12
95	07/16/93	7.5.2
106	03/04/94	11.7.1
109	04/22/94	8.1
117	07/22/94	12.2.1
123	08/16/94	12.2.2.7
125	09/13/94	12.6.4.3
128	11/01/94	12.2.1
129	12/01/95	10.7.1.5

REVISION HISTORY (continued)

MOD No. 132	12/16/94	
N/N-prime Mod Award	Section(s) Changed	
Initial Release S-480-26.1	Document Reformatted and Repaginated	
Sections Renumbered	From	To
	4.2.3	4.2.2.1
	4.2.4	4.2.2.2
	4.2.5	4.2.2.3
	4.2.6	4.2.3
	4.2.7	4.2.4
	4.2.8	4.2.5
	4.2.9	4.2.6
	4.2.10	4.2.7
	5.2.1.2	5.2.1.3
	5.2.4	5.2.3.a
	5.2.5	5.2.3.b
	5.2.8	5.2.8.1
	8.1	8.1.1
	11.10	1.5
	12.6.4.1	8.3.1
	12.6.4.2	8.3.2
	12.6.4.3	8.3.3
Administrative Changes	1.0, 1.3, 2.0, 3.0, 3.2, 4.2.1, 4.2.2, 4.2.5, 4.4, 4.7, 5.2.1, 5.2.1.1, 5.2.8, 5.2.13, 5.2.14.a, 6.4, 7.0, 7.4.2, 7.8, 8.1.1, 8.3.1, 8.3.2, 8.7, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.6.1, 10.0, 10.1, 10.5, 10.5.2, 10.7, 10.7.1, 11.0, 11.2, 11.2.1, 11.2.2, 11.2.3, 11.2.3.1, 11.2.3.2, 11.2.3.3, 11.2.3.4, 11.3, 11.3.1, 11.3.2, 11.4, 11.5, 11.6, 11.7, 11.8.1, 12.0, 12.1, 12.1.2, 12.2.1, 12.2.2, 12.2.2.1, 12.2.6, 12.2.8, 12.3, 12.3.1, 12.6.2, 15.0, 16.0, 16.1.1, 16.2.1, 17.0, 17.1, 18.0, 19.0	
Scope Additions/Revisions	1.0, 1.1, 4.2.2.4, 4.2.3, 5.2.1.2, 5.2.1.3(6), 5.2.1.3(7), 5.2.10, 5.2.13, 6.1, 6.1.1, 6.2, 6.4, 7.0, 7.1.1, 7.1.2, 7.1.3, 7.3.1, 7.4.1, 7.4.2, 7.4.3, 7.5.3, 7.6.5, 7.6.6, 7.7.1, 7.8, 7.8.1, 7.9, 7.10.1, 8.0, 8.1.2, 8.2, 8.3, 8.3.4, 8.6.1, 8.6.2, 8.6.3, 8.6.4, 9.1, 10.0, 10.5, 10.5.1.1, 10.5.1.2, 10.5.2.1, 10.5.2.2, 10.7, 10.7.1.6, 11.1.1.1, 11.2, 11.3, 11.6, 11.8, 11.9.1, 12.1, 12.2.1, 12.2.2.2, 16.1, 18.0, 19.0	
Transfers from Performance Specification, S-480-25	1.5 (entire), 4.2.2.3, 4.3.4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 5.2.1.1.a, 5.2.1.1.b, 5.2.1.1.c, 5.2.1.1.d, 5.2.1.1.e, 5.2.1.1.f, 5.2.1.1.g, 5.2.1.1.h, 5.2.1.3(1), 5.2.1.3(2), 5.2.1.3(3), 5.2.1.3(4), 5.2.1.3(10), 5.2.2(1), 5.2.3.a, 5.2.3.b, 5.2.7, 5.2.7.1.a, 5.2.7.1.b, 5.2.7.2, 5.2.8.2, 5.2.8.3, 5.2.12(1), 5.12.14.b, 5.2.15, 7.8.2, 7.8.3, 10.9	
Deletions (duplicate scope)	12.6.4.3, 5.2.1.1.k	

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MOD No.	DATE	SECTION(S)
134	02/15/95	12.2.1
135	02/22/95	6.2
137	03/07/95	10.5, 10.5.1
138	03/08/95	12.2.1
143	06/02/95	10.10
144	06/12/95	Document Repaginated plus changes in following: 5.2.12, 7.0, 7.1.4, 7.2, 7.2.1, 7.2.2, 7.8.4, 7.9, 8.3, 12.2.1, 12.2.2.2, 12.2.2.3, 12.2.2.4, 12.2.2.6, 12.2.2.9, 16.1, 16.1.1, 18.1, 18.2
148	08/09/95	8.6.2
150	08/16/95	10.7.2
151	08/18/95	12.2.2.7
152	08/22/95	Administrative changes: TOC, 7.9, 7.10, 7.10.1, 8.3.4, 12.2.2.2, 12.2.2.3, 12.2.2.4, 16.2, 18.1, 18.2,
156	09/25/95	7.2.2, 12.3, 16, 16.1, 16.1.1, Table 8.3.4
157	09/25/95	14.5.4
158	09/25/95	10.11
159	10/11/95	8.6.4
163	10/31/95	12.2.2.7
169	02/14/96	12.2.1, 12.2.2.4
170	02/27/96	Administrative changes: 12.2.1, 12.2.2.4
173	04/11/96	11.7.1
174	04/12/96	7.3.2
175	04/17/96	14.1
181	06/26/96	12.2.1
182	06/28/96	10.12
183	07/11/96	8.3.4
186	07/26/96	10.5.1
189	08/15/96	7.3.2
194	10/28/96	10.13
195	10/31/96	10.9
210	02/21/97	7.2.2, 7.8.4, 7.9, 8.3.4, 12.2.7.3, 18.1, 18.2.m
216	04/23/97	11.8, 11.9.1 (Deleted: 11.8.1, 11.8.2, 11.8.3, 11.8.4)
217	05/01/97	5.1, 5.1.1, 5.1.2
220	05/06/07	10.7.2
221	05/09/97	8.8
222	05/09/97	7.10.1
226	06/12/97	11.2.2
231	06/27/97	10.5.1.2
237	08/04/97	11.7.1
239	08/06/97	11.7.1
236	08/08/97	8.3.3

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MOD No.	DATE	SECTION(S)
243	9/10/97	5.2.1.2 (Added 5.2.1.2.1, 5.2.1.2.2)
245	9/23/97	7.9
246	9/23/97	10.4
247	10/10/97	10.5.1.1
248	10/14/97	11.7.1
251	11/19/97	10.5.1.1
253	12/02/97	7.4.4
256	1/08/98	11.7.1
269	2/19/98	11.2.3
279	4/10/98	8.3.4
286	5/11/98	19.2
MOD 295 CCR 1540	7/13/98	8.3.4
314	11/16/98	7
323	03/31/99	7.4.4
324	05/19/99	4.8, 6.4, 10.7.1.6, 19.1
328	06/08/99	11.7
327	06/10/99	7.4.4
331	07/15/99	6.2, 10, 10.7.1.4
333	07/28/99	6.2, 19
349	10/13/99	7.10.1
353	11/18/99	5.1, 5.1.1
366	02/01/00	12.1.1
365	02/17/00	11.3.1
361	02/18/00	7.9
375	05/04/00	4.3, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.2.1.2.1, 5.2.1.2.2, 5.2.7.2, 5.2.13, 5.2.15, 6.4, 12
382	05/04/00	10.9
392	05/25/00	12.2.3
395	06/14/00	12.1.1
394	06/26/00	8.3.4
405	08/24/00	19
410	10/19/00	12.2.2.3
427	03/20/01	11.3.1
MOD 456 CCR 1819	05/21/01	10.5.1.3
MOD 451 CCR 1855	08/07/01	12.2.1
MOD 463 CCR 1851	09/06/01	6.2, 11.2.1, 19
MOD 472 CCR 1811A	07/18/01	14.1, 14.5.4
MOD 481 CCR 1891A	01/07/02	12.2.1
MOD 489 CCR 1893	01/14/02	5.2.2
MOD 500 CCR1808	03/25/02	10.5.1, 10.5.1.2, 10.5.1.4, 10.5.1.4.1, 10.5.1.4.2, 10.5.1.4.3, 10.5.2, 10.5.2.1, 10.9
MOD 504 CCR 1671	04/08/02	11.7.1
MOD 510 CCR 1880A	05/10/02	7.6.5.1
MOD 515 CCR 1934	06/13/02	7.4.4
MOD 523 CCR 1863	08/28/02	6.4
MOD 530 CCR 1914	09/10/02	10.9
MOD 532 CCR 1951A	10/28/02	19.3, 19.3.1, 19.3.2
MOD 527 CCR 1943	09/23/02	10.5.1, 10.5.1.2, 10.5.2

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1 SCOPE

This statement of work defines the tasks required to provide the NOAA-K, L, M, N, and N-prime satellite systems and related items that conform to the Performance Specification GSFC-S-480-25.

This statement of work includes those tasks, facilities and resources necessary to design, procure, fabricate, integrate, test, and support launch of the NOAA-K, L, M, N, and N-prime satellites as well as supply and maintain the satellite AGE. Support tasks at the Satellite Operations Control Center (SOCC) and launch site, in addition to the contractor's plant are also included.

1.1 WORK BASIS

The work to be performed is based on the activities performed by the contractor in providing the TIROS-N, NOAA-A through G and NOAA-H through J satellites and associated items. Except as indicated, the tasks are expected to utilize existing designs and procedures as fully as possible. Unlike the previous activity, where the spacecraft bus and integration and test tasks were carried out under separate contracts, all work for the NOAA-K, L, M, N, and N-prime spacecraft will be under one contract.

1.2 PERIOD OF CONTRACT COVERAGE

The period of contract coverage is from contract award through the launch and in orbit checkout of the last spacecraft. The work to be performed will be integrated, on a NASA/GSFC approved priority basis, with the activities associated with the existing contracts NAS5-28000 and NAS5-29600.

1.3 PMO SUPPORT

The period of performance of the ongoing PMO; Program Management, Scheduling, Configuration Management, Equipment Engineering, Subcontract Engineering, Program Product Assurance, Documentation, Systems Engineering, Instrument Engineering, and ATNAGE Maintenance. The basic coverage for these personnel is covered thru 1/15/89 under NAS5-29600. Thereafter, their coverage will be under NAS5-30350.

1.4 WORK BREAKDOWN STRUCTURE

The tasks described for this procurement shall be relatable to the Work Breakdown Structure (WBS). See attachment #5 to this contract.

1.5 FACILITIES AND FACILITIES EQUIPMENT

Facilities and facilities equipment shall be provided for the development, manufacture, test, checkout, and launch operations support of the spacecraft. The facility environments shall be as required in paragraph 3.2.5 of the Performance Specification, GSFC S-480-25.1.

1.5.1 Development Test Facilities

Facilities shall be provided to accomplish the development tests to be performed on the spacecraft and its components. Material and process testing and pyrotechnic shock response testing shall be accomplished at the contractor's test facilities. Antenna testing for the communications subsystem shall be accomplished at the contractor's antenna test range.

1.5.2 Spacecraft Qualification Test Facilities

Facilities shall be provided to support functional subsystem and spacecraft qualification tests. These tests and subsequent satellite integration testing shall be accomplished in existing facilities furnished by the contractor.

1.5.3 Manufacturing Facilities

Manufacturing facilities shall be provided to fabricate the spacecraft structural parts, antennas, wire harness, and components. These facilities shall accommodate bench integration tests of components before installation into the spacecraft. Facilities to

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support these functions are available and will be supplied by the contractor.

2 APPLICABLE DOCUMENTS

Documents applicable to the tasks shall be those delineated in the Performance Specification GSFC-S-480-25.1. GSFC-S-480-25.1 shall take precedence over all other documents.

3 MANAGEMENT AGENCY

The NASA/Goddard Space Flight Center(GSFC) Tiros Project Office shall be the Government Management Agency.

3.1 CONTRACTOR TECHNICAL LIAISON WITH GSFC

The contractor's primary technical interface will be the GSFC Technical Officer named in the contract. The Technical Officer will identify GSFC personnel who will serve as the key interface for day-to-day technical interchange with the contractor personnel having corresponding responsibilities.

3.2 CONTRACTOR LIAISON WITH OTHER GOVERNMENT AGENCIES AND GOVERNMENT FURNISHED EQUIPMENT CONTRACTORS

All contractor technical coordination with other Government agencies and Government furnished property (GFP) contractors shall be through the Tiros Project Office. Specifically, contractor formal communications, including the required concurrence on interface documents, shall be in writing from the contractor Program Manager and sent through the GSFC Tiros Office to the respective Government agency or GFP contractor. Contractor informal communications with other Government agencies and GFP contractors shall be documented and submitted to the Tiros Office.

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4 PROGRAM MANAGEMENT

4.1 MANAGEMENT PLAN

The contractor shall submit a management plan with his proposal. The management plan shall identify key management personnel who will be assigned to this Procurement.

4.2 PROJECT MANAGEMENT OFFICE

The contractor shall establish a Project Management Office (PMO) given full responsibility and authority to manage and administer all phases of the work specified by this statement of work.

The PMO shall be a single point of contact for NASA/GSFC for all work on this contract. The contractor shall name a program manager with the responsibility for and authority to implement the requirements of this statement of work.

The PMO shall be the single point of control and will be ultimately responsible for all work required by the WBS.

4.2.1 Program Reviews and Meetings

The contractor shall provide the technical and administrative support for all program reviews and meetings including but not necessarily limited to periodic program/spacecraft reviews, spacecraft readiness reviews, design reviews and technical interface meetings.

4.2.2 Design Reviews Program

The contractor shall hold design review meetings in accordance with the requirements of the Performance Assurance Requirements, GSFC S-480-26.1 (contract attachment 7) and as described here-in. Design reviews shall be required for all new and modified designs.

Design review packages shall be prepared to support each review. The data package shall be tailored to the type and intent of the review and may contain, as applicable the following: schematics, block diagrams, test plans and procedures and data results, etc..

4.2.2.1 Preliminary Design Review (PDR)

This review is to be conducted after selecting the design approach and before the detailed design process and the release for fabrication of models for test or delivery. Successful completion of the PDR and close out of all action items provides the technical understandings that are needed to provide a baseline for the detail design efforts.

4.2.2.2 Critical Design Review (CDR)

These reviews shall be keyed with the final "freeze" of the design details of flight hardware/software components and systems. It will be a comprehensive review of the design at the contractor's facility with the contractor, NASA, and NOAA in attendance. The final design review package shall be provided 2 weeks before the date of the review. The contractor's design review response to action items shall be provided to GSFC and NOAA within 2 weeks after receipt.

4.2.2.3 Equipment Design Review

These reviews shall be keyed to the end of the design phase for the unique subsystem/ components and ground-support equipment. The reviews will be planned by the contractor, at his facility, and may have limited GSFC attendance. The final design review (if more than one is necessary) will usually occur at design freeze before start of fabrication of protoflight and flight hardware. Test plans for protoflight and flight components will be a review element. Design review responses shall be provided to GSFC 2 weeks after the review.

4.2.2.4 Design Modification/Upgrade Reviews

All design modifications/upgrades shall be subject to review and approval by the Tiros Project prior to implementation.

4.2.3 Periodic Program/Spacecraft Status Reviews

The contractor shall supply all necessary support for periodic meetings for the purpose of reviewing the overall status of the program. Through the completion of the NOAA-N' environmental test program, the meetings shall be held on a monthly basis. Subsequent to the completion of the NOAA-N' environmental test program, the meetings shall be held on a quarterly basis. A Program Review Presentation Package shall be prepared for each meeting.

The meeting agenda shall include but not necessarily be limited to: program financial status, program action item status review, engineering accomplishments of the past month, overall program schedule status, discussion of topics or problems of central importance to the program, etc.

The contractor shall also supply all necessary support for monthly meetings for the purpose of reviewing the overall status of each of the spacecraft under development. A Spacecraft Review Package shall be prepared for each meeting. The meeting agenda and review package shall include but not necessarily be limited to: program action item status review, spacecraft schedule review, spacecraft open discrepancy status, etc.

4.2.4 Technical Meetings

The contractor shall provide support for technical meetings and reviews as deemed necessary by the GSFC technical officer for the purpose of discussing and resolving program problems or items of interest to the program. This includes at least ten foreign trips with two people per trip.

4.2.5 Spacecraft Readiness Reviews

The contractor shall provide all necessary technical, management (and logistic) support for spacecraft readiness reviews to be held at critical points in the spacecraft flow. These reviews shall be formal meetings held to review discrepancies, test results, and the readiness status of all flight and ground support hardware, software and facilities.

The following readiness reviews shall be held for each spacecraft:

1. Pre-environmental readiness review: This review shall be held at the contractor's facility as close as practical to the completion of spacecraft integration and initial systems test and prior to the start of environmental testing.
2. Pre-shipment readiness review: This review shall be held at the contractor's facility as closely as possible to the completion of all spacecraft testing but prior to the shipment of the spacecraft to the Western Range (WR).
3. Flight Readiness Review (FRR): This review shall be held at WR as closely as practical to the completion of spacecraft and launch vehicle testing at WR but prior to the countdown.

A Review Data Package shall be prepared by the contractor for each of the above reviews. Each data package shall include but not be limited to the following information generated since the previous major readiness review for that spacecraft.

1. Satellite history including: configuration summary; test program flow outline; vibration, acoustic, shock and deployments test flow and data summary; thermal vacuum test profile and test flow and data summary; satellite events chronology; satellite malfunction report summary. The history shall also include operating times for all spacecraft boxes and instruments.
2. Current status including configuration summary.
3. Open item summaries including: open malfunction and defect reports, incomplete test flow items including satellite activities to launch and schedules to resolve open items.

4.2.6 Government Audits

The contractor shall conduct and/or support audits conducted by GSFC or independent contractors assigned by GSFC or another Government agency.

4.2.7 Other Meetings

The contractor shall attend and/or provide the necessary satellite data for reviews of GFP and launch site and launch vehicle held by the Government or other agencies.

4.3 SCHEDULE MANAGEMENT

The contractor shall implement and maintain a scheduling system capable of facilitating the planning, reporting and control on the contract. The scheduling system shall be capable of producing and maintaining the elements described in 4.3.1 – 4.3.4.

4.3.1 Master Schedules

The Master Schedule shall be an overall schedule that summarizes the contract effort. It shall be a one-page chart suitable for presentation purposes. The Master Schedule shall be in contractor format with baseline, progress and current forecast identified (see CDRL 118a).

4.3.2 Integration & Test Summary Schedule

The Integration & Test Summary Schedule shall be a waterfall-type schedule containing all major I&T activities for each spacecraft. The Integration & Test Summary Schedule shall be in contractor format with schedule baseline, progress and current forecast identified (see CDRL 118b).

4.3.3 Detailed I&T Schedules by Shift

The Detailed I&T Schedules by Shift are the work task schedules, planned by shift, for all spacecraft. They shall be in contractor format and represent an informational working “snapshot” of the I&T tasks including one week of history/actuals and two weeks of future planned work (see CDRL 118c).

4.3.4 Intermediate/Cost Account Plan Subtask Schedules

The Intermediate/Cost Account Plan Subtask Schedules identify the baseline plan, actual performance, and current forecast for the effort at the intermediate and cost account subtask levels. These schedules shall be in contractor format and must correlate to the BCWS, BCWP, and ETC contained in the Earned Value Management System (see CDRL 118d).

4.3.5 Contractor Reporting to GSFC

- a. Master Spacecraft Schedule Reporting -- Submit on a weekly basis updated versions of the Master Spacecraft Schedules prepared in accordance with paragraph 4.3.1.
- b. Black-Box Schedule Reporting--Submit on a biweekly basis updated versions of the schedules prepared in accordance with paragraph 4.3.3.
- c. Ground-Support Equipment Schedule Reporting--Submit on a biweekly basis updated versions of the schedules prepared in accordance with paragraph 4.3.4.
- d. Critical Work Periods--During critical work periods, schedule status shall be controlled by daily telephone conversation or datafax between the contractor and the GSFC Tiros Project Office.

4.4 CONFIGURATION MANAGEMENT

The contractor shall revise as necessary, maintain, and implement RCA Document 2308226, "Configuration Management (CM) Plan for Tiros" to carry out configuration management requirements during all phases of spacecraft development. All flight and ground support hardware and software (i.e. computer programs, databases, etc.) shall be included in the CM plan. The CM plan and all revisions shall be submitted to GSFC for approval prior to their implementation.

4.5 PROJECT ENGINEERING

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The contractor shall be responsible for supplying all necessary engineering and other technical support to the manufacturing and test of the component boxes and all subassemblies. Project engineers shall report to and be a part of the PMO. They will be responsible for tracking the schedule progress of all components, evaluating their performance, and reporting of and following up of all manufacturing and test discrepancies.

4.6 SUBCONTRACT ENGINEERING SUPPORT

The contractor shall be responsible for supplying all necessary engineering and other technical support to the efficient procurement of subcontract components and subassemblies. They will be responsible for tracking the schedule progress of all subcontract components and subassemblies, evaluating their performance from the information supplied by the subcontractor, and reporting of and following up of all manufacturing and test discrepancies.

4.7 PROGRAM PRODUCT ASSURANCE MANAGEMENT

The contractor shall be responsible for maintaining the control of subcontractor documents, computer program inputs and reports including standard parts lists, nonstandard parts lists, parts quality status reporting, action items follow-up, test procedure reviews, performance specification reviews, work statement reviews and, as required, support assignments for the program. The Program Product Assurance Manager shall support trend analysis, audits and documentation review as required including TDR's, UER's, FAR's, ECN's and other required functions such as CCB logs. Report(s) on the above shall be included in the Program/Spacecraft Status Review Presentation Package (section 4.2.3).

4.8 IN-ORBIT SUPPORT

The contractor shall provide support for resolution of in-flight satellite anomalies and the TOARB as directed by the Contracting Officer (CO).

4.9 NEW TECHNOLOGY REPORTING

The contractor shall conduct periodic reviews to ensure reporting of new technology is accomplished in accordance with applicable NASA regulations.

4.10 PERFORMANCE MEASUREMENT SYSTEM

This contract shall be performed in accordance with the GSFC Performance Measurements Systems Handbook per the schedule of the contract.

4.11 OFFICE AUTOMATION

The contractor shall provide for office automation in accordance with the schedule of the contract.

4.12 SYSTEM STUDIES

The contractor shall perform system studies in accordance with the schedule of the contract.

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5 DOCUMENTATION

5.1 DOCUMENTATION LIBRARY

The contractor shall generate and maintain a documentation library for the NOAA-K-N= Program. This library may be co-located with other libraries as long as all unique program documents reside in separate locations. All active electronic Program documentation, except those in EDSTAR and controlled using JMM/BOM, shall be stored on the LEOMet server.

5.1.1 Documentation Storage/Control

A. Hard Copy Storage

The contractor shall develop and maintain an electronic Program documentation library that maintains a localized high density hard copy storage system for active documentation (CDRLs). Active documentation is defined as the documentation that is required currently applicable to the contract and for which immediate access is required on a periodic basis by TIROS Project/Program personnel (Program Directives etc.). Non-active Program documentation shall be stored in a formal archival system that provides controlled storage with a retrieval capability not to exceed 5 working days (Non-active documentation includes Documentation Folders for completed assemblies with ABPL and TEST data).

B. Electronic Copy Storage

The contractor shall develop and maintain an electronic Program documentation library for active programmatic documentation. The contractor's central repository shall contain all released drawings and controlled documents in a "read-only" configuration (presently EDSTAR). These documents are change controlled by EJA/ECNs that are initiated by Engineering and submitted to the appropriate CCB for approval. There shall be a record of authority for controlled documents (presently JMM/BOM). Access to documents in the contractor's central repository shall be hard copy. Documents that are in electronic format in the Program library shall be to the latest revision level, stored in a Read-only configuration, and accessible to program/project personnel through computer server access or electronic download by the Program Librarian upon request.

C. Documentation Databases

The contractor shall maintain library documentation control through the development and use of computer databases that reflect the documentation identification, revision level, and location in the library system (hard copy or electronic). The Program Library database shall include active and archived contract documentation.

5.1.2 GSFC/Contractor System Compatibility

The contractor shall develop and maintain a Library hardware and software system that is fully compatible with the GSFC Project Library system. The contractor library system shall have the capability to perform electronic data transfer of documentation to the GSFC Project Library. The contractor documentation shall also be transferred in a format that is compatible with the GSFC Library/user software.

5.2 DOCUMENTATION GENERAL

The contractor shall generate, maintain, and revise as necessary all project documentation; including but not necessarily limited to periodic progress reports, performance specifications, design documentation, technical and program plans, procedures, readiness review data packages, technical reports and spacecraft operations documentation.

Documents shall be supplied to the Government in quantities and within time periods indicated in Attachment 2 "Documentation and Reports". The contractor shall provide the GSFC at least one copy of all applicable non-proprietary program documents upon request.

5.2.1 Periodic Management Reports

The contractor shall provide support for the timely generation of all periodic project documentation including but not limited

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to periodic progress reports.

5.2.1.1 Periodic Progress Reports

The contractor shall provide periodic progress reports as required in the Contract Document Requirements List (contract attachment 2, part C) These reports shall be provided no later than one week after the end of the reporting period. These reports may be copies of the contractor's internal management reports as long as the content meets the basic intent of providing periodic program status. The content format of the reports is subject to the approval of the Tiros Office.

These reports shall include but not necessarily be limited to the following:

- a. Component Design Status -- Provides the design status for each unique component.
- b. Black Box/Subsystem Status -- This portion of the report shall include a tabulation of the required and forecast completion dates for each black box. This tabulation shall be updated as necessary to show completions and revised forecasts. The boxes shall be grouped by subsystem and spacecraft. The following information shall be incorporated into the report.

- Indication of when a box is removed from the spacecraft for rework
- Associated rework date
- Indication of when a box is removed from one spacecraft and used on another
- Forecasted delivery dates for incomplete boxes
- Actual delivery dates (i.e., when a box has been approved by the Defense Contract Administration Service (DCAS) and then put in storage)
- Actual date when a box is physically installed on the spacecraft
- A legend to accompany the report explaining the symbolism

Weekly reports, coincident with the issuance of the weekly black-box schedule, shall summarize the reasons for schedule slippage in those items shown by the schedule printout to have an increase in negative slack.

- c. Spacecraft Status -- Provide the projected start and completion dates for all major activities and events such as integration, detailed electrical tests (DETs), and acceptance test for each spacecraft.
- d. Test Discrepancy Reports -- Provide a cumulative test discrepancy report (TDR) summary for each spacecraft beginning with integration through launch activities. The summary format shall include, but not be limited to, the TDR number, problem description, current status of the problem, individual responsible for "action," and projected closing date. In addition, by using the same format as above, a summary shall be provided that shows the status of all current "open" TDRs.
- e. Rework -- Provide a narrative summary of all major problems, events, or activities encountered during testing at the black box and spacecraft levels.
- f. Configuration Change Request -- Beginning with the design freeze (baseline configuration), provide a brief description of each Class 1 change to be incorporated; units affected, projected dates for completion, and configuration change requests (CCRs) completed for the previous report period.
- g. Technical Memoranda -- Provide a listing and a package of all contractor internal technical memoranda related to events and activities affecting this and related programs. (Listing to be reproduced; package to be mailed.)
- h. Purchased Parts -- A Parts Shortage List shall be supplied to identify those vendor-supplied parts whose late delivery is impacting box-completion schedules. The list shall be arranged on a box-by-box basis.
- i. Subcontract Component Status
- j. Spacecraft Bar Chart Schedules
- k. Class II Changes

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l. Waivers and Deviations

m. NSPARS

A copy of each progress report shall be sent to the Tiros Office by phone facsimile as soon as possible after it is prepared.

5.2.1.2 Financial Status Reports

5.2.1.2.1 Monthly Reports

The contractor shall submit a monthly Program Earned Value Management System (EVMS) report (formats 1, 2, 3, 4, and 5) in accordance with contract attachment 8 and the requirements below.

Format 1 Reporting

PMS Format 1 shall report per the contract Attachment 5 WBS levels.:

Additionally, the contractor shall report elements of cost by burden pool at WBS level 1.

Format 4 Reporting

The contractor shall provide level 2 OBS man-hour forecast loading (LRE), and level 1 OBS element of cost forecast (LRE) according to the following time phasing:

Cum Actual thru prior month
Current Month Estimate
Next six month(s)
Following quarter
Balance of Fiscal Year
Following 2 fiscal years
Balance of Contract
Total At Completion

Format 5 Reporting

The top five cumulative period cost and schedule variances shall be explained in terms of cause, impact and corrective action for all WBS level 2 activities with current period variance +/- \$100K, cumulative variance +/- \$400K, and variance at completion +/- \$400K.”

Changes in the Estimate at Completed (EAC) since the prior reporting period shall be reported at WBS level 1.

5.2.1.2.2 Budgetary Reports

For NASA budget requirements a modified 533Q format will be required as needed. The modified format should be as follows:

Level 1 cost by element (labor, overhead, material, etc. through sell dollars) phased by month for up to 24 months of the Government Fiscal Year, phased by quarter for the balance of the Government Fiscal Year, for 1 year and one (1) fiscal year thereafter, then phased by year for the remainder of the contract. KLMNN' will not be segregated but an estimate by time period of the percentage split between KLM and NN' will be provided.

All cost information should reflect the most current assumptions, estimates, and schedule. All authorized changes should also be included at full value phased as above. All cost information should indicate the costs identifiable for the KLM program separate from the NN-prime program. Any LOE accounts which cannot be split between the two programs should be assigned a percentage split.

5.2.1.3 Other Periodic Reports

Other management reports may be provided as mutually agreed upon or considered necessary by the Government. These shall include but not necessarily be limited to the following:

1. Configuration Management Progress Reporting
A report summarizing engineering change notice (ECN) activity, and problems shall be submitted as part of the program review handout.
2. Safety Progress Reporting
Safety progress reports shall be submitted as part of the program review handout as applicable.
3. R&QA Monthly Report
The contractor shall submit reliability and quality assurance documentation for approval as specified in S-480-26.1.
4. Mass Properties and Power Report
The contractor shall supply both power utilization budget and mass property reports on a quarterly basis, as a minimum. Both reports shall include power utilization and spacecraft mass properties as a function of time or events during the orbital phase. The reports shall be detailed, including each subsystem and instrument. As a minimum, the values for the current report and the previous report shall be shown for each of these reports.
5. Major Milestone Matrix
6. Performance Measurement System Reports (includes required NASA Form Monthly and Quarterly 533 information)
7. K, L,M, N, and N-prime Family Tree
8. Configured Article List
9. Data Base
10. Test Reports
The contractor shall provide analysis and test reports on the structural dynamics model, the antenna test model, and system design verification tests. The contractor shall also provide one copy of any applicable program document (nonproprietary) upon request.

5.2.2 Design Documentation

The contractor shall update as necessary and maintain the design documentation on all hardware and software for flight

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components and systems and AGE and associated process and test procedures and related equipment. In addition to assembly drawings, design documentation shall include, yet not be limited to the following items:

1. Logic diagrams of all spacecraft systems and components.

The contractor shall update as required overall spacecraft logic diagrams and shall prepare a set of systems schematics that shall identify all instrument and subsystem interface connectors and pin assignments. A schematic representation internal to each subsystem shall be included. Interface connector and pin assignment locations shall be evaluated to ensure that spacecraft harness requirements are met. Internal schematic representations of subsystems shall be evaluated in terms of applicable performance requirements to determine compliance with approved design practices.

The format of spacecraft logic diagrams shall include schematics of the following types for all spacecraft subsystems.

- Command list
- TIP analog T/M pin assignment
- Digital T/M pin assignment
- Command distribution
- Power distribution
- Thermal control
- Flight adapter
- Subsystem internal circuitry and interface circuits
- Instrument interface circuitry

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2. Logic diagrams of the spacecraft support and power-up equipment and its interface to the spacecraft in the various test configurations.

3. Flow charts and verbal description of all flight and ground software.

4. TIP, AIP, and MIRP Data Formats

5. Command List

6. Telemetry List

7. Systems Design Report

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5.2.3 Interface Control Documentation

- a. GFE Interface Documentation -- The contractor shall prepare and maintain the interface specifications on the GFE specified in S-480-25.1 Table 1 that are defined by contractor specification numbers. The contractor shall also prepare and maintain a heat flux and radiation coupling analysis report and a spacecraft thermal interface drawing for the externally mounted GFE specified in S-480-25.1 Tables 1 and 2. These documents shall be submitted to GSFC for approval.
- b. Satellite - Ground System Interface Document -- The contractor shall provide definition of the interface

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between the satellite and the postlaunch ground stations. This document shall record the agreement of ground-system/spacecraft compatibility for which acceptable performance has been predicted and for which measurement of that performance may be made. The information on the spacecraft interface shall be provided by the contractor, and the information on the ground-system interfaces shall be provided by the NASA Tiros Project Office, based on data obtained from the National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Service (NOAA/NESDIS). Spacecraft DCS equipment not supplied by MMAS shall have information provided by NASA. This document shall be signed by the contractor, NASA, and NOAA representatives. Launch support interface description will not be part of this document.

The ground systems to be covered by this document are as follows:

- Fairbanks, Alaska, CDA station
- Wallops Island, Virginia, CDA station
- Western Space and Missile Center
- European TIP dump station
- Standard HRPT station
- Standard direct readout TIP station
- Standard APT station
- Standard DCS platform
- Standard SAR Local User Terminal (LUT)
- Standard SAR Emergency Locator Transmitter (ELT)
- Standard SAR Emergency Position Indicating Radio Beacon (EPIRB)
- USAF SCF Standard Site

The satellite interface shall cover all received data RFlinks, from the receiving antenna through the decoder, and the transmitted data RF links from input to the transmitter through the antenna radiation into space. All possible cases of modulation and functional states allowed by command able switching to data paths on the spacecraft shall be included. Bandwidths (including any premodulation filtering), spectrum definition, emitted power spectral density, and antenna patterns shall be included. In addition, the spacecraft interface shall include the data formats for TIP direct, TIP playback, HRPT, local area coverage (LAC), global area coverage (GAC), and APT as they appear when presented to the spacecraft transmitter; the command format as expected by the spacecraft command receiver; and the DCS message format as expected by the DCS receiver. ADACS ephemeris update data requirements shall also be included.

The ground-system interface shall cover all elements originating at the space/ground antenna interface through the frame synchronizer for digital links or through the video detector for the APT link. Antenna coverage, including mechanical limits and terrain limitations, shall be included for the CDA stations, and band limiting shall be defined for the ground station elements. Link analyses, based on the foregoing systems and interface definitions, shall be documented with definition of the space link included. Nominal and worst-case altitudes and nominal and worst-case attitude control, based on the spacecraft final design, shall be used. An update of the satellite-ground system interface document shall be written to include the AMSU system interfaces.

5.2.4 Section Reserved

5.2.5 Section Reserved

5.2.6 Readiness Review Data Packages

The contractor shall provide data packages and full support for the following readiness reviews.

- a. Preenvironmental Test Readiness Review
- b. Preshipment readiness Review
- c. Prelaunch Readiness Review at the launch base
- d. Design changes PDR's and CDR's

5.2.7 Plans and Procedures

The contractor shall provide a top level planning diagram and maintain as conditions warrant, specific plans and procedures

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for preparing for and outlining operations. Required plans and procedures include but are not necessarily limited to the following: general test plan, manufacturing plan, satellite storage and call up plan, including; a battery handling plan and a solar array handling plan.

5.2.7.1 Test Plan

The contractor shall supply and maintain a comprehensive test plan which covers all subassembly, component, subsystem, and spacecraft testing and includes a description of the basis rationale for all testing and how assurance verification is made, that all components and systems meet specification via the testing performed.

- a. Spacecraft Test Plan -- The contractor shall submit a detailed spacecraft test plan covering all aspects of the test program including such items as:

- Test models
- Component/subsystems - prototype and flight
- Spacecraft integration
- Spacecraft acceptance testing

Any changes to the test plan shall be submitted for GSFC approval.

- b. Ground-Support Equipment Test Plan -- The contractor shall provide a test plan describing the test program for the unique ground-support equipment including the software, whenever major changes are made.

This plan shall include, but not be limited to, the following:

- A definition of the format and source of test data and parameters
- A description of the results of each acceptable test
- The inclusion of anomalous data/operations to ensure proper input data screening in new development testing

5.2.7.2 Test Procedures

The contractor shall update and maintain the following test procedures.

- a. Unique Component Test Procedures -- The contractor shall prepare and submit for the Tiros Project Office review test procedures for unique component testing. Test procedures for DMSP common components shall also be submitted. These procedures shall be designed to meet the requirements described in the applicable portions of Section 4 of S-480-25.1
- b. Spacecraft Test Procedures -- The contractor shall prepare detailed test procedures in accordance with the requirements of the applicable portions of Section 4 of S-480-25.1. These procedures shall test all overall spacecraft bus operations, interfaces, and spacecraft functional performance requirements and shall cover specialized tests such as solar array deployment and the environmental exposure tests described in S-480-25.1 paragraph 4.4. Procedures shall be submitted to the Tiros Project Office for review.
- c. Ground-Support Equipment Test Procedures -- The contractor shall prepare test procedures for checking unique ground-support equipment including software. These test procedures shall be submitted to the Tiros Project Office for review.
- d. Propellant Handling Procedures -- Special handling procedures for handling of propellants shall be provided in accordance with the requirements of S-480-25.1 paragraph 3.6.1.8.

5.2.8 Performance Specifications

5.2.8.1 Subsystem/Component Performance Specifications

The contractor shall maintain performance specifications for all components and the following subsystems: Thermal,

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Reaction Control, Attitude Determination and Control, Electrical Power and Distribution, Communications, Command and Control, Data Handling, Flight Load Package, Structure, Harness.

Instrument performance shall be covered through the general and appropriate unique interface control specifications.

5.2.8.2 Spacecraft Computer Program Specifications

Spacecraft computer program specifications for the software elements that are new with the NOAA-K through N-prime program shall be maintained and delivered. These specifications shall include, but not be limited to, the following:

- A narrative description of the approach to be taken in implementing the requirements
- Flow charts describing the logic of the programs
- A tabulation of program constants and other parameters
- A description of all hardware and software interfaces
- A description of all program inputs, intermediate data, and outputs
- A timing analysis
- An estimate of hardware and software margins
- Additional information required for maintaining the software

The spacecraft software requirements shall be contained in PS2285510, "General Requirements - Tiros-N Software." A document shall be prepared to supplement these specifications as an aid in understanding the details of the computer programs including their operation with the executive system.

Annotated listings and a copy of the source code on magnetic tape shall be delivered for all programs. Also, a core-load image shall be delivered on magnetic tape for each release of the onboard software during its development process.

5.2.8.3 Ground-Support Equipment Computer Program Specifications

Ground-support equipment computer program specifications shall be updated and delivered when major changes are made. This documentation shall address the application programs individually and as a system. The specifications shall include:

- A narrative description of the approach to be taken in implementing the requirements
- A tabulation of program constants and other parameters
- A description of all hardware and software interfaces
- A description of all program inputs, intermediate data, and outputs
- An estimate of hardware and software margins
- Additional information required for maintaining the software
- A users manual

Annotated listings and a copy of the source and object code on magnetic tape shall be delivered for all programs within the system.

5.2.9 Spacecraft Database

The contractor shall establish, update, and maintain a spacecraft database for each satellite.

5.2.10 Submission of Document Changes

Specifications, and design, fabrication and test documents used for NOAA-K, L, M, N, and N-prime which remain unchanged from the previous NOAA spacecraft development do not need to be resubmitted to GSFC for approval or review. All new or updated documentation shall be submitted to GSFC for either review or approval as specified in the documentation list. See Attachment #2 to the contract.

5.2.11 Age Sensitive Components List

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A list of spacecraft age critical items shall be maintained showing the sequence in time that each age critical items comes due for evaluation, rework, or rejection on the basis of age.

The contractor shall maintain a storage plan consistent with the spacecraft shelf life.

5.2.12 Technical Reports

The contractor shall provide all technical reports and memorandums when they become available. Such reports shall include but not necessarily be limited to the following:

1. System Design Report
At the conclusion of the NOAA-K,L,M system design, the contractor shall provide a detailed report covering all changes of the new and modified designs of the spacecraft from the NOAA-H through -J Systems Design Report and the Tiros unique ground equipment. This report shall be submitted to GSFC for review at the completion of the NOAA-K through -M system design. At the conclusion of the NOAA-N and N-prime system design, the contractor shall issue a corresponding report covering changes from the NOAA-K,L,M design.
2. Spacecraft Activation and Evaluation Report
3. Power Utilization Budget Report
4. Mass Properties Report
5. Analysis and Test Reports
 - a. Structural Dynamic Model Report
 - b. Antenna Test Model
 - c. System Design Verification Tests
 - d. System Analysis

5.2.13 Spacecraft Operations Documentation

The contractor shall provide and maintain documents giving descriptive operating characteristics for use by spacecraft operations personnel and shall provide all other documentation necessary to plan for, operate, evaluate, troubleshoot, and utilize data from the spacecraft.

This documentation shall include, but not necessarily be limited to the following:

1. Alignment and Calibration Handbook, including instrument data.
2. Programming and Control Handbook which shall include but not be limited to command/telemetry response tables, information on redundancy, commanding, power source and distribution, clock sources, and telemetry points and all other systems operating characteristics. A new handbook shall be issued for K, then updated as necessary before shipment of each satellite to WR.
3. Satellite Launch Operations Handbook (LOHB) will be updated for each launch of the NOAA-K, L, M, N, and N-prime satellites. The NOAA-J (LOHB) shall be updated for NOAA-K.
4. Launch Operations Test Procedures will be updated for each launch of the NOAA-L,M,N, and N-prime satellites.

5.2.14 Documentation/Data Archiving and Disposal

- a. The contractor shall maintain historical data, in either hard copy or digital tape format, following the launch and activation of each spacecraft. The Government will be notified prior to the planned destruction or disposal of irreplaceable documentation and no such disposal will take place without the Government's permission.
- b. The contractor shall provide as requested spacecraft tapes containing outputs of telemetry and attitude determination data for each spacecraft at the time of the pre-environmental review. Instrument calibration data tapes will be

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provided by the contractor as requested after thermal vacuum testing.

5.2.15 Logbooks

Logbooks of all integration and test activities shall be maintained in accordance with the following:

The contractor shall maintain a test record for each component and spacecraft. The primary record for each component shall be the test data sheet containing measured values or checkoff indicators for each test procedure step. All test discrepancies or alterations in test procedure flow shall be documented. All test documents relating to the component shall be available in a documentation folder that travels with the component (before component acceptance) or maintained in a library (after acceptance). Descriptions of troubleshooting and corrective actions shall be filed in the documentation folder upon completion of test problem resolution. Spacecraft documentation shall be as previously described except that:

A chronological logbook shall be maintained for each spacecraft. The logbook will describe the activity of each shift, major events, and discrepancies.

Test documentation shall be initiated at the first electrical test and shall be available thereafter to the GSFC technical officers and project engineers for review and selected page reproduction at the contractor's facility.

The logbook shall be made available to the Technical Officer and NASA resident.

6 SYSTEMS ENGINEERING

6.1 SYSTEMS ENGINEERING

The contractor shall be responsible for all systems engineering for the NOAA-K, L, M, N, and N-prime satellites. It is the responsibility of systems engineering to ensure that all components and systems meet their intended design and performance specifications and that the design specifications are sufficient for mission success.

Systems engineering shall include but not necessarily be limited to support of the following areas of satellite and AGE development: hardware and software design, interface specification and evaluation, component test, data review and evaluation, rework, troubleshooting, support of spacecraft integration and test and all other work through the launch, on-orbit checkout and in-flight anomaly evaluation of the spacecraft.

The generation, revision as required, and review of documentation, test plans, and test procedures, plus their implementation and evaluation for all stages of satellite development shall be included.

6.1.1 Requirements Traceability Upgrade - (N/N-prime)

The contractor shall establish an automated system (CASE tool) to trace all requirements to ensure that each system and derived requirement has an associated test requirement(s) and each test requirement has an associated test(s). The contractor shall implement the CASE tool as no later than the start of NOAA-N component testing.

6.2 GFE-INSTRUMENT INTERFACE MANAGEMENT

The contractor shall provide instrument interface contacts to maintain and control at RCA/ASD an interface of the Government Furnished Equipment (GFE) instruments for the NOAA-K, L, M, N, and N-prime spacecrafts. This also includes maintaining and updating the interface specification and reviewing any changes to the GFE instruments. The contractor shall also provide for the evaluation of instrument operation throughout the testing program period. This period begins with the incoming inspection and extends to the last spacecraft launch under this contract. No support is included for the bench testing of Digital Tape Recorders (DTR's) or Solid State Recorders (SSRs), the Data Collection System (DCS) or the Search and Rescue Processor - Memory. It is also understood that instrument data review is a joint Government/ Contractor effort. Table 2 in GSFC-S-480-25.1 lists the instruments for NOAA-K, L, M, N, and N-prime and paragraph 2.5 lists the instrument interface specifications.

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The following instruments will fly on NOAA-K, L, M, N, or N-prime for the first time or be significantly modified from the versions flown on earlier spacecraft. Each will require extensive effort to develop Unique Instrument Interface Specifications.

- a. Argos II--The Data Collection System will incorporate a new instrument design (Argos II) for NOAA-K, L, M, & N (only). The weight and power will be increased over the previous version and 32 TIP Digital A words will be required. Mechanical, thermal, electrical, and data processing tasks will be required to accommodate the new instrument.
- b. Advanced Microwave Sounding Unit (AMSU)--Three new instruments will be flown on NOAA-K, L, M, N, and N-prime, AMSU A1, AMSU-A2, and AMSU-B. Mechanical, thermal, electrical, and data processing design and analysis tasks will be required to support these instruments. NOTE: The AMSU-B instrument will not be flown on the NOAA-N and N-prime satellites. It will be replaced with the Microwave Humidity Sounder (MHS), section 6.2.f.
- c. Search and Rescue Processor (SARP)--The SARP will maintain the same functions as in previous flights, however, the mechanical design will be modified. Mechanical, thermal, and harness redesign tests will be required to support this instrument. This instrument will be flown on NOAA-K,L,M, & N (only).
- d. Space Environment Monitor (SEM)--The SEM will consist of the Total Energy Detector (TED) and the Medium-Energy Proton/ Electron Detector (MEPED) and a Data Processing Unit (DPU) as flown on earlier spacecraft. However, a new procurement will be initiated, which could result in a different thermal, mechanical, and electrical interface. Mechanical, electrical, thermal, and data processing tasks will be required to support this instrument.

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- e. Advanced Very High-Resolution Radiometer (AVHRR)--The NOAA-K, L, M, N, and N-prime AVHRR will have six channels and a larger mechanical size. Since only five channels of data will be processed by the Manipulated Information Rate Processor (MIRP) at one time it will be necessary to modify the Flight Software to command alternate channel configurations each time the spacecraft flies over the earth's day/night terminator. Mechanical, electrical, thermal, data processing, and flight software tasks will be required to support this instrument.
- f. Microwave Humidity Sounder (MHS) -- The MHS shall be flown on the NOAA-N and NOAA-N- prime in place of the AMSU-B. Mechanical, thermal, electrical, and data processing design and analysis tasks will be required to support this instrument.
- g. ARGOS III—The Advanced Data Collection System (A-DCS-3) will have transmitting capability (if utilized). A-DCS-3 functions have been implemented in two boxes. This unit will be flown on NOAA-N' satellite only.
- h. Search and Rescue Processor-3 (SARP-3). SARP-3 has the same foot print as SARP-2 with some enhanced capability. This unit will be flown on NOAA-N' satellite only.
- i. Solid State Recorders (SSRs) – One Solid State Recorder shall be flown on NOAA-M (in place of one Digital Tape Recorder). Three SSRs shall be flown on each NOAA-N and NOAA-N' (in place of the five DTRs).

6.3 SKILL CENTER ENGINEERING SUPPORT

The contractor shall be responsible for supplying all necessary engineering and other technical support to the tasks associated with the required design and/or redesign of the flight and AGE hardware and software. This shall include, but not be limited to, the generation of associated specifications, design and assembly drawings and procedures, interface documentation, and the performance of associated design development and evaluation testing and analysis, as well as all necessary support to the project engineering and manufacturing and test operations and the evaluation of anomalies once the equipment is used on or with the spacecraft.

6.4 FLIGHT SOFTWARE MAINTENANCE

The contractor shall provide maintenance of the NOAA-K, L, M, N, and N-prime flight software including analysis of spacecraft anomaly reports, and to change constants in the flight software affected by spacecraft configuration changes.

Flight code modifications (exclusive of constant changes) shall be performed only if authorized by the Government. A written direction from the CO shall authorize the modification or improvements to be performed and includes making the coding change, documentation of the change, performing module level and system level testing, and transmitting module listings and load tapes to the Government. The contractor may recommend modifications to the flight software via submission of a letter to the Government describing the change.

The contractor's written analysis of the effort required to implement a change will include an estimate of the effort required for implementation of the coding change, and an estimate of the effort required for validation testing.

The contractor shall deliver interim load, test load and flight load package listings and load images to NASA/GSFC on hardcopy and on electronic media as they become available in order to support independent validation and NOAA training exercises. The format and media of TLP and FLP products shall be standardized with DMSP so the products can be used by the SOCC Flight Code Management Software. Load image shall include PDF and load map, memory image, file checksum, and package symbol file for CPU-1, CPU-2 and ULP or ILP and source code (assembler input) for all modules. Build listings symbol list by name, symbol list by address, checksum table, load map by address, load map by name, ULP or ILP with ILP TLP1/TLP2 or FLP1/FLP2 overlay hex dump.

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Errors uncovered during GSFC IV&V shall be corrected.

6.5 FLIGHT AND GROUND SOFTWARE MANAGEMENT PLAN (SMP)

The contractor shall develop a Software Management Plan (SMP) encompassing all software development activities. This SMP shall apply to all applications, operating systems and utility software in both ground and flight software systems, and shall address all significant phases of the developmental process.

More specifically, the SMP shall address as a minimum, (a) software systems engineering (implementation policies and

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standards, schedules, interface control, data management, etc.), (b) design reviews, (c) requirements definition and control, (d) software design and implementation, (e) resource management (memory, disc space, time, etc.), (f) test and delivery, (g) documentation (identification of deliverable documents with objective of each) (h) configuration management and (i) performance assurance.

7 SPACECRAFT DESIGN

System and component design for the NOAA-K, L, and M shall be based on that of the NOAA-H through J spacecraft except for the indicated changes herein. The NOAA-K, L, and M design shall be used for the NOAA-N and N-prime except as noted below. The contractor shall be responsible for developing the appropriate changes to the spacecraft design and all associated documentation and procedures for assembly and test.

The contractor shall control and manage the design and distribution of satellite functions in order to ensure that the mission requirements are met. These areas shall include but not be limited to the following: power, fusing, telemetry, commands, available space, available field of view, and frequency use.

The system redesigns shall be limited to those areas that require modification because of a change in the requirements, or because of component, part, or material obsolescence or unavailability. All system design reviews and design changes shall meet the requirements of GSFC-S-480-25.1.

A spacecraft system design review shall be conducted for the baseline NOAA-NN' design. The review shall consist of a total system overview, focusing on individual subsystem requirements, design and performance assessment, including changes from the NOAA-K, L, M design. Previous NOAA-NN' design reviews and action item responses shall be summarized. Review presentation material is not required to be submitted to NASA prior to the day of the presentation.

7.1 MECHANICAL STRUCTURE/THERMAL

The contractor will design the necessary changes to assure adequate spacecraft structure in compliance with GSFC-S-480-25.1.

The contractor shall design the necessary thermal changes as a result of the other design changes covered in this section and as may be needed to meet the requirements of GSFC-S-480-25.1.

7.1.1 Spacecraft Modeling

For N/N-prime the contractor shall generate a three dimensional computer model of the spacecraft, to include all fields of view of instruments, attitude sensors, and antennas, the bare spacecraft structure, and fully integrated panels. This model shall be available to enhance the speed and flexibility of spacecraft reconfiguration as required.

7.1.2 Design Change - ESM Structure (N/N-prime Upgrades)

For N/N-prime, the contractor shall perform mounting tolerance verification for the AMSU-A2.

The contractor shall perform an FOV analysis for the SBUV using an updated SBUV model that includes the SBUV baffles.

7.1.3 Design Change - RSS Structure (N/N-prime Upgrades)

For N/N-prime, the contractor shall perform and implement the following engineering design changes:

- a. Redesign the S-Band Omni (SOA) Mounting Assembly as a welded/machined mounting assembly (versus dip brazed) so as to eliminate tolerance verification processes during assembly and to reduce the rejection rate
- b. Redesign the Safe & Arm and Regulator interface brackets to provide enhanced assembly and integration and eliminate interference adjustments
- c. Redesign Purge Line Bracket Layout to improve the positioning accuracy and provide better producibility

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- d. Modify RSS Lower Ring to improve accommodation of the S/A Boom.
- e. Design the necessary changes to the RSS to accommodate a new battery design as described in Paragraph 7.4.3.

The design change shall be verified for flight via engineering analyses.

7.1.4 Design Change - Adapter Structure (N/N-prime Upgrade)

For N/N-prime, the contractor shall design and implement a modification to the Launch Vehicle Adapter to accommodate the Delta II mounting interface, and to incorporate separation springs.

7.2 REACTION CONTROL AND PROPULSION SYSTEM (AKM)

7.2.1 Propulsion System (AKM)

NOAA-KLM

The contractor should design the necessary changes to the NOAA-HIJ propulsion system to accommodate the AKM as specified in 16.1.

NOAA-N and N-Prime

The contractor should design the necessary changes to the NOAA-KLM propulsion system to delete the AKM.

7.2.2 Reaction Control System (NOAA-N and N-prime)

The contractor shall design and implement deletion of all hydrazine components from the RCS. A simplified nitrogen cold gas RCS shall be implemented.

The contractor shall modify all associated equipment procedures, and documentation, including but not limited to, the following:

- Spacecraft assembly drawings
- Wire connection lists
- Command list
- Telemetry List
- I&T procedures
- Launch Operations Manual
- Programming and Control Handbook

7.3 ATTITUDE DETERMINATION AND CONTROL SYSTEM (ADACS)

The Contractor shall perform or update as required the attitude control system analyses and performance evaluations relating to the definition of all on-board control loop parameters and software requirements and supply the documented results to the GSFC Technical Officer.

7.3.1 Design Change - Reaction Wheel Assembly Upgrade (N/N-prime)

The NOAA-KLM RWA wheel bearing assembly is no longer available. Therefore, for N/N-prime, the contractor shall perform the efforts required to define and integrate an alternate RWA design into the N/N-prime spacecraft, including update of existing KLM ADACS analyses and development of software to accommodate a replacement RWA design.

7.3.2 Design Change - Attitude Safehold System

The contractor shall perform a combined phase A/B Safehold study for the TIROS M, N, and N= spacecraft. The purpose

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of the study is to review existing redundancy management for attitude control, then investigate various options for implementing an autonomous Safehold control system for the TIROS spacecraft. The system should maneuver the vehicle to a thermally stable power safe attitude without damage to any instrument in the case of an on orbit attitude anomaly. This study is intended to trade off various designs and concepts, including approaches developed by Code 700 and those proposed for the EOS Common Bus, DMSP, and Landsat 7. The design should provide a capability for autonomously assuming control of the spacecraft during anomalous conditions. It will also provide the tradeoffs for new ideas that could enhance the current redundancy management and attitude control system with additional hardware, such as a GPS, a TAM, or a CSS, and/or software systems that shall utilize the existing redundant control electronics and provide capabilities similar to the autonomous Safehold System. When these trade studies and ideas have been fully explored, the results will be presented to the POES Project together with a recommendation for the best method for implementing the Safehold function on the spacecraft. This System Concept Review (SCR) should consider all items such as defining the requirements for the design options, budgetary cost (ROMs) for the design options, tradeoff matrices detailing the assets versus the liabilities of each option, reliability versus the system complexity, schedule and other items as required for completeness. Following the SCR, the Project will select a design approach.

7.4 ELECTRICAL POWER SYSTEM

The Contractor shall provide for each spacecraft, a quarterly electrical power profile, including an electrical power summary for all phases of operation.

7.4.1 Design Change: Power Converter Elimination

The Contractor shall eliminate the 5 volt power converter from the NOAA-K, L, M, N, and N-prime design and develop an alternate 5 volt source for units such as the digital tape recorders and RF transmitters.

7.4.2 Design Change: Increased Instrument Power Load

The Contractor shall incorporate the necessary power system designs to accommodate the increased power demands of the NOAA-K, L, M, N, and N-prime payloads.

7.4.3 Design Change - Battery Cell Design Upgrade (N/N-prime)

For N/N-prime, the contractor shall perform the design and analysis efforts required to accommodate a new battery cell vendor source into the KLM S/C design. (The battery cell design for the NOAA-KLM is no longer available.) A full battery qualification test shall be performed for one complete qualification battery assembly (9 cell pack & 8 cell pack). Cells for DPA and Life Test shall be procured by the contractor and provided, upon request, for use by the GSFC/TIROS Project. Life testing shall not be performed by the contractor as part of the new cell

design upgrade effort.

7.4.4 Instrument DC/DC Converter Operating Frequency Change

The contractor shall characterize the spacecraft main power and pulse load buses in the frequency range from DC to 100 kHz, 100 kHz to 500 kHz and 500 kHz to 1000 kHz. Appropriate measurements should be performed on NOAA-M as a baseline and repeated on NOAA-N for comparison. The characterization of the NOAA-N spacecraft main power and pulse load busses shall include the measurement of current ripple in addition to voltage ripple. Both voltage and current ripple shall be measured approximately at the same time (to facilitate impedance computation). The spacecraft should be fully integrated (bust components and payload) and powered in the high bay (during T/V would be desirable).

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7.5 COMMAND AND CONTROL SYSTEM

7.5.1 Design Change: Encrypted/Authenticated Command Link

The Contractor shall design and encrypted/authenticated coding technique for the command link. Analysis and system level tests shall be performed to demonstrate command system performance under simulated link noise conditions. The encrypted and command system shall meet the requirements of GSFC-S-480-25.

7.5.2 Design Change: RXO Frequency Performance Monitoring

The Contractor shall provide the capability for measurement and perform monitoring of the RXO frequency drift throughout spacecraft system level tests for the purpose of engineering information and evaluation (not as pass/fail

STATEMENT OF WORK FOR THE NOAA-K, L, M, N, & N-PRIME SATELLITES conditions for SEPET or Aliveness tests). A TDK shall be written for anomalous performance. Design and implementation shall preclude introduction of things such as noise and ground loops on spacecraft harnesses, subsystem components or instruments.

7.5.3 Design Change - SCU Upgrade (N/N-prime)

For N/N-prime, the contractor shall review and modify the SCU design to improve producibility of the SCU. All KLM SCU drawings shall be converted from manually generated drawings to a CAD system. A board by board review shall be performed and the SCU board designs shall be modified to enhance the design and improve producibility. Design changes shall be verified via a protoflight test program.

7.5.4 Solar Array Shunt Drive Circuitry Testing

For NOAA-N and N' Solar Array testing shall be conducted at panel and wing level to test for open and short-circuited diodes for each of 70 shunt drive circuitry on the Solar Arrays.

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7.6 COMMUNICATIONS

7.6.1 Design Change: S-Band Command Link

The command communication link will utilize an S-Band Carrier with GSTDN compatible modulation scheme.

7.6.2 Antenna Pattern Testing

The Contractor shall perform 1/3 scale (including solar panel simulation) and full scale antenna pattern tests to verify that radiation specifications are achieved. A report of this activity including power profile plots shall be provided.

7.6.3 SBA Ellipticity

Through relocation of the existing design antennas or through use of cross dipole antennas with ground planes (but without use of deployable antennas) the Contractor shall make a "best effort" to achieve the SBA 4.5 db ellipticity goal as stated in GSFC S-480--25 paragraph 3.6.1.5k. It is understood that structural constraints and sensor fields of view will limit the extent that existing design antennas can be relocated.

7.6.4 UDA Mounting

The Contractor shall enhance UDA gain performance by mounting the antenna on a standoff no greater than six inches in height.

7.6.5 Design Change - S-Band Transmitter Upgrade (N/N-prime)

For N/N-prime, the contractor shall review and redesign the KLM solid state power amplifier (SSPA) to improve producibility and improve the tuning characteristics of the SSPA. The upgraded design shall be verified via a protoflight test program.

7.6.5.1 STX Oscillator Filter Section Stability Enhancements (N-prime)

For the N-prime spacecraft, in an effort to maintain bandpass stability, the contractor shall enhance the current STX design by modifying the STX oscillator filter section. The enhanced filter section shall reduce the residual stress within the capacitor and eliminate the potential of solder creep associated with the current design.

An interim design review shall be held to cover the changes made to the filter section of the oscillator.

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7.6.6 APT Transmitter Frequency Change (N/N-prime)

The contractor shall provide APT transmitters (VTX1 and VTX2) that shall operate at the carrier frequencies as specified in the TIROS Spacecraft Performance Specification, GSFC-S-480-25.1, Paragraph 3.6.1.5(f), Table 7.

7.7 DATA HANDLING

The data handling system shall meet the requirements of GSFC-S-480-25.1.

7.7.1 Design Change - XSU Upgrade (N/N-prime)

For N/N-prime, the contractor shall redesign the XSU to improve producibility and I&T ease of installation. The X5V filter board shall be designed to reside within the XSU box. The upgraded design shall be verified via a protoflight test program.

7.8 FLIGHT SOFTWARE (ON-ORBIT)

The NOAA-K, L, M, N, and N-prime flight software shall be derived from the NOAA-J flight load package and modified to meet the requirements of the NOAA-K, L, M, N, and N-prime missions. A modification is required to command alternate channel configuration of a six channel AVHRR instrument each time the spacecraft crosses the earth's day/night terminator. All flight software design shall be in accordance with requirements specified in this statement of work and GSFC-S-480-25.1.

7.8.1 Design Change - Flight S/W Code Review & Annotation (N/N-prime)

For N/N-prime, the contractor shall perform a review of all embedded flight software modules against on-orbit data and requirements and implement improvements to the software, where applicable. As part of this review, the software module code will be annotated with English language comments/descriptions.

7.8.2 CP-234 Software Assembler

The CPU software assembler used to provide the load package software shall be converted to run in batch mode on a Government NAS 9050 computer. An acceptance test shall be developed and demonstrated using dial-up capability, on the NAS 9050 computer, verifying proper operation after conversion. Any proposed changes to this assembler shall be presented to the Government for review.

7.8.3 Ancillary Flight Software

The Contractor shall develop and maintain for flight use, the software routines entitled SADBIAS, DESPIN and SPINAMP to support in orbit spacecraft contingencies.

7.8.4 Design Change - Separation to Handover (NOAA-N and N-prime only)

The contractor shall design, integrate, and test additional Flight Software to perform the following tasks:

- a. Accept three independent separation discretes to initiate Flight Software control of the spacecraft after separation.
- b. If STX transmission is not allowed for the initial phase of launch and ascent, act on discretes from the launch vehicle and turn on the STX at a designated time after launch.
- c. Null rates
- d. Perform deployments in sequence.
- e. Hand over to Orbit Mode Software
- f. Acquire Earth

7.9 ASCENT GUIDANCE SOFTWARE (AGS) (NOAA-K,L,M only)

The NOAA-K, L, M ascent guidance software shall be designed to meet the orbital requirements as specified in GSFC-S-480-25.1. The contractor shall provide the support required to assure the following list of items are satisfied:

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<u>ITEM</u>	<u>DESCRIPTION</u>
Physical Modeling	Define total upper stage physical model time histories for weights, inertias, center of gravity, and propulsion for use in trajectory and vehicle dynamics simulations. Also define 3 sigma tolerances on all salient vehicle model parameters.
Dynamic Modeling	Generate the dynamic environment loads to the S/C IMU resulting from launch vehicle contractor defined S/C flight loads. Analyses includes random, steady-state and vibrational accelerations as well as S/C flexible body bending affects.
Control System Modeling	Define the upper stage control system requirements via software simulations of the upper stage dynamic environment (including guidance transfer functions) so as to insure proper switch line characteristics and gain/phase relationships for S/C stability and controllability throughout the appropriate flight regimes.
Trajectory Simulation	Develop a working trajectory (duplicating some of the parameters of the launch vehicle contractor defined baseline trajectory) for various upper stage flight dynamics studies such as: the effect of Titan errors at separation on the orbit injection errors, variations in RCE propellant usage including velocity trim requirements, 3 sigma orbit injection errors due to all sources, etc. and for use in the guidance and control system design and analysis.
Error Model	Generate a dynamic error model for the upper stage (thrust, ISP, propellant loading, IMU sensitivities, etc.) for use in determining the closedloop trajectory errors. These errors, together with launch vehicle contractor provided Titan dispersion errors at S/C separation will be the basis for orbit error analyses and for determining the spacecraft hydrazine budget for trim velocity.
Orbital Studies	Determine orbital error sensitivity matrices, covariance matrices, and distribution functions from closed loop trajectory simulations. With these data, produce a final orbit error analysis.
Guidance Software	Provide the upper stage guidance software mechanization and implementation into the flight kinetics system model. This includes selecting a guidance law and the guidance computer algorithms and coding such as to optimize computer storage usage, reliability, vehicle performance and orbit accuracy.
Guidance Systems	Generate the necessary software to Simulations simulate the baseline trajectories, and with guidance and control loops closed, fully verify the S/C guidance program operational integrity for the total range of the S/C dynamic environment. Those simulations should utilize the flight SCP-234 or an emulation of the SCP-234.
Prelaunch Testing	Generate all the S/C prelaunch test software to fully validate the IMU alignment, proper control system functioning, IMU guidance computer interface polarities and guidance computer control system interface polarities. A total flight simulation of the guidance program (using artificial IMU outputs) will also be required using the actual NOAA-K, L, M, N, and N-prime mission constants.
Mission Constants	Generate Nominal S/C mission constants (derived from the launch vehicle contractor provided baseline trajectory) to be used in verifying the flight software.
Guidance Integration	Provide integrated documentation which adds launch vehicle contractor data to MMAS data in the following areas: <ul style="list-style-type: none"> a. Total vehicle physical model b. Total Vehicle dynamic model c. Total Mission nominal (baseline) trajectory including: <ul style="list-style-type: none"> - Sequence of events - Control programs - Dynamic environment - Thermal profile - Tracking station look angles - Launch window data d. Total vehicle error model

<u>ITEM</u>	<u>DESCRIPTION</u>
Guidance Support	Provide technical support to NASA/launch vehicle contractor in the following areas:

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- a. S/C physical/propulsion model
- b. S/C dynamics model
- c. S/C preferred trajectory targeting scheme
- d. S/C prelaunch test software definition
- e. IMU error model

Post Flight Analysis Provide a boost phase post flight analysis for the first and second Titan II flight. The analysis shall cover the AGS performance from prelaunch through ascent to handover.

7.10 COMPUTER PROCESSING UNITS

The Contractor shall secure a supply of Bootstrap ROM's immediately to be available for upgrade of CPU memory to 64K words for six (6) flight CPU's, six (6) ground CPU's, and spares. In addition the Contractor shall proceed to

fabricate 64K memory CPU's for NOAA-K. Purchase of additional parts required to upgrade NOAA-L CPU's to 64K memory shall be made relative to schedule need and cost efficiency.

7.10.1 Design Change - CPU Bootstrap ROM Upgrade (N, N-prime)

For N, N-prime, the contractor shall redesign the Bootstrap ROM configuration in the KLM 64K CPU design to improve FLP up-link performance. The redesign shall provide for additional capability to perform an on-orbit download of a complete flight software package from PROM into the 64k RAM via ground command initiation. The upgraded CPU design shall be verified via a protoflight test program.

8 BOX FABRICATION, ASSEMBLY, AND TEST

The contractor shall fabricate, assemble, and test or procure through suitable subcontractors who shall fabricate, assemble, and test the various components necessary for five complete spacecraft, excluding items supplied as GFP. This includes the boxes which make up the spacecraft subsystems identified in the WBS I.E. (1) through (11).

8.1 SPACECRAFT BATTERIES

8.1.1 NOAA-KLM

The contractor shall provide three sets of primary batteries, two sets of workhorse batteries and enough cells for; two sets of back-up flight batteries, one qualification battery and a life test pack. A set of batteries consist of three batteries or six battery packs. Back-up cells should be provided by an alternate source from the primary batteries because the same source cannot be used as a back-up. The cells for these batteries shall not be a third electrode type. The contractor shall provide 12 battery cells from each flight lot for life testing by GSFC. Two of the 12 battery cells in each life test lot are to be equipped with a pressure transducer. Additionally, one of the DPA cells from each lot must be provided with the test cells.

8.1.2 NOAA-N/N-prime

The contractor shall provide two sets of primary batteries, one set of workhorse batteries, one qualification battery, and enough cells for a life test pack and DPA.

8.2 COMPONENT TESTING (NEW OR MODIFIED UNITS)

New or modified units for use on NOAA-K, L, M, N, and N-prime shall be considered as protoflight units and shall receive full qualification testing. Flight level tests shall be carried out on all other units.

8.3 COMPONENT SPARES

The contractor may utilize spare components as may be available from previous NOAA series of spacecraft procurements. No additional component spares except one each UDA, SRA, SLA, two SOA antennas and one V-Band shall be purchased or fabricated for the NOAA-K, L, and M spacecraft. The contractor shall prepare a list of those usable spare components that are available from the previous contracts. In addition one AKM shall be provided as a spare. This AKM shall be delivered with a designated NOAA-K, L, or M, AKM.

8.3.1 Critical Components

A set of critical components, or suitable alternatives as concurred by the GSFC/ Tiros Project Office, shall be established and held in reserve inventory. The set shall consist of the following:

<u>Part No.</u>	<u>Description</u>	<u>Quantity</u>
2303067-2	4K RAM	455
2303072-11 thru 19	ROMS	3 of each P/N
2303073-1	MAC	10
2593412-1	MEC	36
2613170-1	2 BIT ADDER	36
2291080-5	1K RAM	15

8.3.2 Gyros/IMU

A set of three (3) Dry Tuned Gyros and one (1) 300 Series IMU shall be established and held in reserve inventory. The gyros and IMU shall be of flight quality and suitable for use in the NOAA K, L, M spacecraft.

8.3.3 Rolling Spares Implementation

The contractor shall make NOAA-N/N' boxes compatible with NOAA-M without building additional spare NOAA-KLM boxes. The total NOAA-KLM sparing plan will be achieved through internal printed wiring board removal, external connector patches, replaceable harness segments and harness segment adapters.

8.3.4 N-prime Component Spares

The contractor shall provide a set of component spares for the N-prime spacecraft as defined in the Table below. These components shall be available to support N-prime, the last TIROS spacecraft, from Spacecraft I&T through launch site operations. These components shall be regarded as expendable units available for use as spare components or subassembly hardware as required. These components shall not be designated as contract line item deliverables at the component level and shall be reported as residual inventory at contract close-out.

Subsystem	Component Assembly	Quantity per S/C	Quantity to be Spared
Structure	V-Band Assy	1	1
Thermal	TCEs	36	9 (1 each type)
RCPS	NEAs	8	2
	FLR	1	1
	PXs	1	1
	FDs	1	1
ADACS	MIMU	2	1
	ESA	1	1
	SSA	1 Set	1 Set
	RWAs	4	1
EPDS	CPC	1	1
	Battery	3	4
	SAD	1	1
	ADE	1	1
	PSE	1	1
	BCA	1	1
	BRU	3	1
	SATCU	1	1
C&CS	RXO	1	1
	CPU	2	1
	CIU	1	1
	CXU	1	1
	SCU	1	1
	DAU	1	1
Comm	GRD	2	1
	VTX	2	2 (1 each type)
	BTX	2	2 (1 each type)
	SOA	6	4 (1 each type)
	STX	4	4 (1 each type)
	SBA	3	2 (1 each type)
DHS	AIP	1	1
	TIP	1	1
	XSU	1	1
	MIRP	1	1
	MIU	1	1

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8.4 AGE-SENSITIVE COMPONENTS

8.4.1 Flight Batteries

Electrolyte shall not be added to battery cells until needed to build up the battery in time for supplying it to the spacecraft to support pre-ship operations.

8.4.2 Pyrotechnic Devices

All pyrotechnic devices shall be manufactured and delivered on a schedule which minimizes the possibility of the parts exceeding their useful life before launch.

8.5 COMPONENT TESTING

The contractor shall provide the necessary testing and data analysis needed to verify that all components fully meet their intended performance specifications and that in doing so the performance of the systems of which they are a part will also be met.

8.6 FACTORY TEST EQUIPMENT

The contractor shall utilize the general and special purpose factory test equipment purchased under previous Tiros/NOAA series contracts. Priorities and conflict resolution shall be decided by the Tiros Project Office. Modifications to this equipment shall be made as required, but shall not preclude testing of satellite units for those earlier contracts. New factory test equipment required by this contract shall be designed, documented, fabricated, validated for proper performance, and maintained.

The contractor shall make full use of government special test equipment which are compatible with ATN-KLM flight equipments.

8.6.1 Battery Test Fixture Modification (N/N-prime)

For N/N-prime, the contractor shall redesign and modify the BATTs mechanical test fixture to be suitable for use on either the KLM battery or the new N/N-prime batteries as specified in section 7.4.3.

8.6.2 Reserved

8.6.3 Solar Array STE Upgrade (N/N-prime)

For N/N-prime, the contractor shall replace the existing obsolete manual Solar Array STE with a automated Solar Array STE. The automated STE shall have the capability to perform the Solar Array ATP testing more quickly and accurately and provide automated data collection and data print-out capabilities. The contractor shall make the modification(s) available for use no later than the NOAA-N Solar Array ATP.

8.6.4 MIRP STE Upgrade (N/N-prime)

The contractor shall design and fabricate a new MIRP STE to provide improved performance and reliability over the existing KLM MIRP STE. The contractor shall also develop and provide the test software required to operate the upgraded MIRP STE and to provide the additional capability to simultaneously process multiple MIRP data streams in near-real time, to display error events in near-real time, and to input erroneous data into the STE to support developmental and diagnostic activities. The contractor shall make the modification(s) available for use no later than the NOAA-N MIRP ATP.

8.7 MECHANICAL HANDLING AND PROPULSION SYSTEM SERVICING AND TEST EQUIPMENT

The contractor shall utilize the mechanical handling and propulsion system servicing and test equipment purchased and

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used under the previous Tiros/NO M series spacecraft contracts. Priorities and conflict resolution shall be decided by the Tiros Project Office. Equipment purchased or fabricated under those earlier contracts may be modified for use on this contract but must still be able to support the earlier contract work.

8.8 TEST HARDWARE

The contractor shall provide one portable SCP automated test equipment (P-SCATE) to ensure STE availability through the period 2002-2005.

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9 QUALITY ASSURANCE AND SAFETY, RELIABILITY AND QAE

9.1 PERFORMANCE ASSURANCE IMPLEMENTATION PLAN

The contractor shall prepare a Performance Assurance Implementation Plan in accordance with GSFC-S-480-26.1 for this NOAA-K, L, M, N, and N-prime procurement. It shall include the Quality Assurance, Reliability, and Safety Implementation Plans.

9.2 RELIABILITY AND QUALITY ASSURANCE AND PROGRAM SAFETY REQUIREMENTS

The Performance Assurance Implementation Plan to be utilized shall meet the requirements of GSFC-S-480-25.1 and shall be submitted to GSFC for approval prior to the start of work on this contract. No changes shall be made to these plans and/or their implementing procedures without prior GSFC approval.

9.3 CONTAMINATION CONTROL

The contractor shall prepare a contamination control plan as part of the Performance Assurance Implementation Plan in accordance with GSFC-S-480-26.1. The plan shall fully describe the contractor's efforts to minimize and monitor both particulate and non-volatile organic contamination. Contamination control, as depicted in the plan, shall meet the requirements of GSFC-S-480-25.1. The contractor shall be responsible for analyzing witness mirrors periodically, as depicted by the plan to ensure compliance with the requirements.

9.4 PARTS AND MATERIALS LISTS

The contractor shall supply separate lists of the parts and material and process plans both per-design and as-built, used in each spacecraft including subcontracted hardware. The parts and material lists shall include and identify by item both the RCA standard-preferred and non-standard items. The non-standard items shall be identified by the drawing/specification nonstandard if any, and the manufacturer's number and name. The parts and materials lists shall be submitted per the deliverable documents list. The contractor shall also perform the redesign and testing necessitated by parts obsolescence or quality upgrade.

9.5 GFE PAYLOAD R&QA

The contractor shall develop and implement special requirements for R&QA evaluation and coverage of the GFE payload and other spacecraft components which are Government furnished.

The Unique Interface Specifications shall be the source of any special handling, storage, environmental and contamination control, or other requirements that may apply.

9.6 SYSTEM SAFETY

The contractor shall prepare a System Safety Implementation Plan (SSIP) as Section 4 of the Performance Assurance Implementation Plan in accordance with GSFC-480-26.1. It shall incorporate safety requirements during all phases (including design, fabrication, integration, test, storage, transportation and launch operations) of the development and operation of the spacecraft and associated ground equipment, including radioactive materials. It shall be submitted to GSFC for approval.

9.6.1 Launch Related Safety

The fourth document listed in 2.1 of the GSFC-S-480-25.1 shall be utilized as the referenced safety manual for launch related spacecraft design.

The contractor shall provide to the launch vehicle contractor, through GSFC, the satellite unique data for use in range documentation.

9.7 CONFIGURATION MANAGEMENT/MONITORING

Configuration Management monitoring shall be in accordance with the schedule of the contract.

9.8 SPACECRAFT MISSION ASSURANCE

Mission assurance tasks in the spacecraft integration and test areas shall include but not be limited to the following tasks:

1. At predetermined inspection points in the spacecraft integration procedures and as otherwise considered necessary the Mission Assurance personnel shall ensure that all assemblies have been constructed in conformance to the appropriate drawings of the proper revision.
2. Assure that all handling and other operations are in conformance with generally considered good practice and the appropriate quality instructions.
3. Verify that the details of the spacecraft flow are properly documented and that all procedures steps have been performed and all noticed discrepancies documented.
4. Verify that all test configurations are properly documented and setup.
5. Verify that the environmental conditions of the spacecraft operations areas stay within the appropriate specifications.
6. Verify that there are no ALERTS against the spacecrafts that will affect performance.

9.9 SPACECRAFT INTEGRATION/TEST/LAUNCH OPERATIONS MANUAL

The contractor shall develop, maintain appropriate handling instructions and assure that personnel are properly trained for handling operations.

A spacecraft operations manual shall be revised and maintained to aid the training of all personnel working with the spacecraft hardware and periodic training courses shall be given. The contractor shall assure that all appropriate certification and required recertification of personnel is carried out.

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10 AEROSPACE GROUND EQUIPMENT (AGE)

AGE here is defined as all the equipment, extraneous to the spacecraft that supports spacecraft development, assembly, integration and test, shipping, and checkout at the factory and during launch operations, including the Advanced Tiros-N Ground Station Equipment (ATNAGE) System and all associated equipment, all other Ground Support Equipment (GSE), both mechanical and electrical, including the Spacecraft Support Racks, Spacecraft Test and Power-up Equipment, miscellaneous common test equipment, mechanical handling and lifting fixtures and special test fixtures, including that for alignment and thermal vacuum testing.

AGE does not include the following: instrument bench checkout equipment, factory test equipment, or facilities.

The contractor shall provide for all AGE required to support the NOAA-K, L, M, N, and N-prime satellite test program and launch operations except for that special hardware or software associated with the SARM and SARR and A-DCS (NOAA-N' only).

10.1 CONTRACT COVERAGE FOR AGE

AGE hardware and software shall be provided from the ATNAGE and associated equipment provided under contracts NAS5-28000 and NAS5-29600 and shall be used on an integrated basis with the work on-going from those contracts.

All AGE shall conform to GSFC-S-480-25.1. Where necessary, the contractor shall modify the hardware and/or software for both the ATNAGE's to meet the requirements of this contract while maintaining the ability to support satellites being procured under earlier contracts. The two ATNAGE's shall remain independent from each other.

Specific periods of contract coverage for maintenance of hardware and of software, shall be as indicated in Attachment 5.

10.2 AGE DOCUMENTATION

The contractor shall provide a list of controlled hardware and software and documentation for the same that comprise the ATNAGE, other AGE and associated equipment.

The AGE shall include but not be limited to items to be provided by the Government.

The contractor shall document all changes and additions to the ATNAGE hardware and/or software requirements documents, specifications, hardware drawings, and software logic charts and listings, hardware and software maintenance manuals and the ATNAGE operations manual. The above shall comprise the ATNAGE controlled documentation.

The object magnetic tape and operating instructions for any software development software not provided by the computer manufacturer shall be supplied by the contractor.

10.3 AGE ACCEPTANCE TESTING

All AGE required on this contract shall be tested (i.e., calibrated, proof tested, acceptance tested) and its operation verified prior to its use with the spacecraft, its components, or related equipment.

AGE test plan shall be submitted to GSFC for approval.

10.3.1 ATNAGE Acceptance Testing

The contractor shall demonstrate proper performance of the capabilities of the ATNAGE in an acceptance test whenever modifications of the ATNAGE hardware and software are made in order to meet the requirements to support the test and launch operations. Such tests shall be based on a test plan which is approved by NASA and shall be successfully completed before the modified hardware/software items are needed to support spacecraft test.

10.4 AGE SPARE PARTS

A recommended list of spare parts shall be developed by the contractor. The objective of maintaining a spare parts inventory shall be to reduce the time to repair system faults and where possible to reduce the cost of maintenance by reducing faults.

The contractor shall also provide the spare parts required to support the NOAA-K, L, M, N, N' operational S-Band command system at the Wallops Island and Fairbanks CDA stations, and shall ship the selected spare parts to these CDA facilities.

The contractor shall maintain an ATNAGE spare parts inventory based on the agreed upon contractor/GSFC shared parts list.

10.5 AGE MAINTENANCE

Maintenance of the hardware and software elements of the AGE shall be provided by the contractor through the launch and early orbits of the NOAA-K, L, M, N, and N-prime satellites. The objectives of this maintenance are to reduce down time by providing effective preventative maintenance services, to provide timely repairs when failures are detected to minimize down time, and to provide continuity of maintenance services for all elements of the AGE in a cost effective manner.

10.5.1 AGE Hardware Maintenance

The contractor shall provide preventative and remedial maintenance services for all hardware elements of the AGE as required to insure its availability to support satellite development and launch activities. These services shall include manpower, replacement hardware parts and procedures as required, shall be provided at LMSSC and at the WR as required by the master schedule, and shall be provided continually and with continuity. Maintenance of the computer systems shall be provided by either LMSSC or the system manufacturer.

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The required maintenance shall include, but not be limited to, the development and implementation of an effective preventative maintenance system, the repair or replacement of faulty system hardware elements, the redesign of system elements found to be difficult to maintain, the redesign or replacement of system or subsystem elements as dictated by parts obsolescence, limited refurbishment of system elements, developing "work-arounds" as required to insure system availability, resolving hardware/software interface problems, providing support as required to resolve software problems, and documenting all hardware maintenance activities.

10.5.1.1 Obsolete Equipment Replacement

a. ATNAGE Analog Recorders

The contractor shall upgrade/replace the NOAA-HIJ vintage analog recorders in use on the ATNAGE for the NOAA-KLMNN-prime spacecraft testing.

b. RF Equipment

The contractor shall replace obsolete spectrum analyzers and oscilloscopes in the telemetry data receiver racks in both ATNAGE systems for the NOAA-KLMNN-prime spacecraft testing.

c. Automated Operating System (AOS) Spacecraft Simulator

Upgrade the AOS spacecraft simulator as required to process S-band spacecraft commands.

Replace existing AOS Simulator mini computer with a PC-based simulator computer.

The implementation of these replacements shall be commenced immediately after award of the contract modification.

10.5.1.2 ATNAGE Equipment Upgrades

The contractor shall implement the following changes to upgrade the ATNAGE hardware:

a. Reserved

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- b. Augment the present 1600 bpi, 1/2-inch reel magnetic tape five units with 2.0 Gigabyte, 4mm format "cassette type" magnetic tape drive units so as to provide a minimum of 12 hours continuous data recording.
- c. Reserved
- d. Upgrade the 3 Spacecraft Simulator RF downlink generators to be interchangeable frequency synthesized models.
- e. Upgrade the manual decommutation capability to accept and process data from either the TIP or the AIP data stream by software selection.
- f. Provide command receiving equipment at the launch facility as required to verify the operation of the command link from the ATNAGE to the launch pad.

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These changes shall be implemented for use no later than the start of NOAA-N Bus integration.

10.5.1.3 AGE Hardware Upgrade

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The contractor shall upgrade the thermal vacuum racks as follows:

- a. TIROS Fail Safe Rack –

Replace the 80-manual potentiometers with 8-10 unit modules of VXI formatted PC programmable resistors. This allows for remotely commanding the decade resistors via a PC. In other words, this rack modification allows for computer controlled remote actuation of set point temperature changes for both the TCE heaters and the louver actuator heaters. It will also be necessary to add an interface card system (GPIB to MXI) between the rack and the PC, in order to enable the computer to drive the system.

The existing 2 – 28Vdc power supplies will be replaced with new units of similar capability, and the existing 40 relay circuits required to control power to the flight TCE's must be refurbished. These relays do not require replacement, but rather need to be cleaned, checked for proper operation, and replaced only if non-functional.

- b. STC and FTC Racks –

Replace the STC and FTC racks with 2 – 2 Bay, 19", 40 channel racks with PC programmable solid state controllers. These 2 identical test heater control racks could be used interchangeably, but would be dedicated to the 32 spacecraft and 39 test fixture heaters, respectively. The existing 71 (total for both racks) 13 Amp power supplies are acceptable as is, and would need to be supplemented with 9 new power supplies. This upgrade provides a total capability of 80 channels of solid state, PC programmable temperature control, utilizing a T-type thermocouple feedback signal. The 80 total channels provides for 9 spare control zones, thus satisfying the test industry standard "spare rule" of 10%.

- c. HELIUM Cryogenerator –

Purchase one new Sterling cycle helium cryogenerator with 40 watts or more of cooling capacity, to be plumbed and utilized in parallel to the existing cryogenerator. This will require new DELTA vacuum chamber plumbing hardware to support vacuum jacket lines and isolation valves from each unit. During testing, both units will operate simultaneously, providing a parallel cooling circuit outside of the vacuum chamber. These vacuum jacketed lines will then be merged (beyond the respective isolation valves of the 2 units) into a single vacuum jacketed line entering the DELTA chamber through its original single entry port plate.

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d. TCE, ATC and Variac Racks

Replace both the TCE and ATC racks with a new 24 channel test rack combining the functions of each. This new 24 channel system will dedicate 12 channels for the old TCE function, and 10 channels for the ATC. Two additional channels will be provided to satisfy a 10% spare requirement. The Variac rack will remain unchanged, since it is only used for test contingency operation. All of the breadboard TCE's will be replaced with PC programmable solid state heater controllers which will accept thermistor input for feedback control. Four (4) new power supplies will be utilized to provide rack power for all 24 channels of zone temperature control. Additionally, 2 VXI programmable resistors will be required to provide for the IMU set point resistance and SATCU/MAST temperature set points.

e. Cameras and Camera Rack –

Purchase 4 new Pulnix camera bodies, and 12 new variable focal length lenses, to provide a total of 12 operating cameras and 2 spare units. Also, purchase 12 narrow beam vacuum compatible in-chamber light sources. Additionally, modify and/or refine the existing motion sensing software to allow for the new in-chamber test hardware, and to be more flexible with regards to poor or stray lighting and general false triggering.

10.5.1.4 AGE Longevity Enhancements**10.5.1.4.1 Summary**

The contractor shall perform upgrades to the legacy ATNAGE systems utilizing an incremental approach.

The contractor shall develop a detailed Implementation Plan that includes technical approach and schedule. This plan shall describe how the requirements listed in 10.5.1.4.2 and 10.5.1.4.3 will be met.

10.5.1.4.2 General Requirements

- a. The contractor shall hold monthly technical interface meetings that will include a review of build plans, acceptance testing, overall status, and schedule updates.

The upgrades shall:

- b. Eliminate the Data General computers within ATNAGE 1, 2 and the offline computer
- c. Maintain the components and functionality of the legacy ATNAGE system until a build replacing such components and functionality has completed acceptance testing.
- d. Perform for the final build, all processing functions performed by the legacy ATNAGE, including execution of heritage ATLAS procedures and the Statistical Analysis System
- e. Be fully documented including training material, software documentation and hardware maintenance manuals
- f. Provide an ATNAGE system maintainable for 10 years after completion of upgrades
- g. Utilize commercial-off-the-shelf hardware and software where practical
- h. Be implemented in a manner that will not interfere with ongoing TIROS I&T and launch activities
- i. Incorporate commonality with the ATNAGE system and the TIROS Satellite Operational Control Center system in Suitland, MD where possible. At a minimum, provide data compatibility.

10.5.1.4.3 Specific Replacement Items

The following hardware items shall be replaced:

- a. Aydin Bit Synchronizers
- b. Data General Frame Sync Boards

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- c. Data General A and B computers (from ATNAGE 1 & 2)
- d. Data General Offline computer.

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The following software functionality shall be re-hosted:

- a. Health and safety instrument monitoring
- b. ATLAS Runtime Software
- c. Bus Software
- d. ATLAS Compiler
- e. Database Generators
- f. Instrument science processing

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10.5.2 ATNAGE Software Maintenance

The contractor shall provide maintenance services for all elements of the software systems within the ATNAGE as required to insure its availability to support satellite development and launch activities. These services shall include manpower, diagnostic software and computer time as required, shall be provided at LMSSC and at the WR as required by the master schedule, and shall be provided continually and with continuity. The software to be maintained shall include all real time - consisting of BUS, lo-rate, hi-rate and off-line operating systems, applications, utility and maintenance elements utilized within the ATNAGE. Maintenance of purchased software may be provided by either LMSSC or the systems developer.

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The required maintenance shall include, but not be limited to; the identification and resolution of software anomalies; the implementation of minor software modification to enhance system operability, to accommodate limited changes in requirements, or to identify and resolve interface problems; the development and utilization of "test software modules" to facilitate fault-isolation and the development of work-arounds for system-level problems; the implementation of system data base changes; and the development for a "System Readiness Procedure" to demonstrate the operability of the system.

10.5.2.1 System Software Upgrade - (N/N-prime)

The contractor shall upgrade the ATNAGE software operating system to the current revision level. The contractor shall also upgrade the system and/or applications software as required to integrate and effectively utilize approved replacement and upgraded hardware.

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10.5.2.2 Applications Software Compatibility - (N/N-prime)

The contractor shall modify, as required, all applications software to be compatible with system software upgrade(s) (Paragraph 10.5.2.1).

10.5.3 Maintenance Plan

The contractor shall show contracted-for services and in-house support, including direct, shared, and indirect.

10.5.4 Maintenance for GFP AGE

The Government will supply the following AGE equipment to be associated with the ATNAGE one HRPT display, two APT displays and three digital logic recorders.

10.6 EXPENDABLES

The contractor shall supply all expendables for the ATNAGE and the ATNAGE-GFP equipment that the contractor maintains under this contract.

10.7 GROUND-SUPPORT SOFTWARE SYSTEM (GSSS)

The ground-support software system shall be developed or modified to operate on the ATNAGE and ancillary ADP equipment and shall satisfy the requirements of GSFC-S-480-25.1.

10.7.1 Instrument Software

Instrument software described in the following paragraphs shall be provided to operate concurrently in the ATNAGE A, B, and C computers as described in RCA NAGE specification, 2285033.

A subset of the instrument software shall be provided to concurrently and continuously check all instruments with this checking applied to all or any combination of instruments as the test in progress demands. Concurrent and continuous software capabilities shall be per GSFC-S-480-25.1.

All instrument software shall be operational as required to support the NOAA-K, L, M, N, and N-prime integration and test schedule. A documentation package consisting of descriptions of the new software and change sheets for previously documented software shall be supplied consistent with the documentation supplied under NAS5-28000 and NAS5-29600.

10.7.1.1 Computer B Software

All Bus software as defined in RCA 2295960, ATNAGE Requirements, shall be provided. In addition, the Bus Software System must be capable of:

1. Transmitting control information data to the high rate instrument software system in the A computer
2. Receiving and displaying all information transmitted from the high rate instrument software system in the A computer
3. Generating 9-track 1600 bpi digital tapes containing AMSU-A and/or AMSU-B and appropriate ancillary data for distribution to the instrument manufacturers, and processing 9-track 1600 bpi digital tapes containing AMSU-A and/or AMSU-B and appropriate ancillary data received from the instrument manufacturers.

10.7.1.2 Computer A High Rate Instrument Software

All high-rate instrument software as defined in RCA 2295960, ATNAGE Requirements, shall be provided.

10.7.1.3 Spacecraft Simulation Computer Software

The low rate/high rate instrument simulator software as defined in RCA document 2295960 shall be provided. All applicable software developed under contract NAS5-28000 shall be utilized. The simulator shall be capable of receiving and transmitting simulated RF signals to and from the ATNAGE.

10.7.1.4 Computer C Low-Rate Instrument Software

All low-rate instrument software as defined in RCA 2295960, ATNAGE Requirements, shall be provided. Additionally, the C-Computer Software System shall be capable of interfacing with, and processing the data generated by the DCS-2 and A-DCS-3/SARP-2 and SARP-3 System Test Equipment (STE) as defined in the Preliminary Design Review (PDR) Package, Annex 6, CNES Document APP/ITL 322, dated June 1988. This processing does not include A-DCS downlink data at 466MHz.

10.7.1.5 Instrument Data Distribution

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The contractor shall provide the capability to:

- 1) selectively extract data from ATNAGE history tapes;
- 2) format this data in binary, or its ASCII representation, and to package this data for distribution; and
- 3) output this data to 3-1/2" floppy discs, to data transmission lines via modem interface, or to hard copy.

The required system shall be capable of pre-defining to a maximum of 99 standard data sets, or of defining alternate data sets at the time of a data extraction request. An extraction criteria shall also be provided which permits the extraction of selected data sets from the history tape by spacecraft time, ground time, subsystem status, etc.

This capability shall be designed and implemented to be compatible with the Graphic System activities. Detailed requirements shall be developed and documented by the contractor and shall be approved by GSFC prior to implementation.

This capability shall be provided no later than the start of NOAA-K EMI.

10.7.1.6 Instrument Test Software Maintenance

The contractor shall provide maintenance for the NOAA-KLMNN-prime instrument test software including analysis of improvements or test anomaly reports and to change the software as it is affected by instrument configuration or data reduction configuration changes.

A written direction from the CO shall authorize modification or improvements to be performed and includes making the coding change, performing module level and system level testing, and incorporation into the ATNAGE instrument software.

The contractor's written analysis of the effort required to implement a change will include a brief description of the method of adopting the modification, an estimate of the effort required for implementation of the coding change, and an estimate of the effort required for validation testing.

10.7.2 Analysis and Display Software

The contractor shall develop, operate, and maintain a Statistical Analysis and Graphic Display System patterned after that recommended by Lockheed Martin in response to Task Assignment 63 under contract NAS5-29600, and documented in the associated final report, ATTIROS-N ATNAGE-2 Workstation Enhancements. The system shall be capable of operationally accepting, archiving, retrieving, processing, and distributing properly formatted data produced by the NOAA-K through N= spacecraft and received from approved sources.

The data storage and retrieval system shall be designed and implemented in accordance with Section III B of Appendix A to the Performance Specification for the NOAA-K through N= satellites.

The contractor shall develop, compile and document the detailed requirements for the Statistical Analysis and Graphic Display System, and shall conduct a Preliminary Requirements Review (PRR) and a Critical Requirements Review (CRR). The resultant Class 1 document, AOperational Requirements for the Statistical Analysis and Graphic Display System, shall be the primary input to the associated system design effort. The contractor shall conduct a Preliminary Design Review (PDR) and a Critical Design Review (CDR) of the System Design.

The contractor shall also provide a remote data analysis capability in space provided at the GSFC. This effort shall include all necessary hardware, software and installation activities.

10.8 DOCUMENTATION FOR ATNAGE

The deliverable documentation for ATNAGE shall be that identified in attachment #2.

10.9 TIROS DYNAMIC FLIGHT SIMULATOR (TDFS)

The contractor shall perform the following support efforts for the TDFS and associated equipments:

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- Modify and utilize a Tiros Dynamic Flight Simulator provided as GFE to support spacecraft simulations, ATNAGE checkout, interface and procedures verification, flight software development, validation and verification, and personnel training.
- Provide maintenance and configuration management for all TDFS software for three simulators (NOAA/SOCC, LMSSC and Tiros Emulation Processor (TEP)).
 - Operating system software for all simulator work stations and rack-mounted single board host computers is to be at the identical revision level.
 - Revise the NOAA/SOCC simulator (TTS) software such that a CDA loop back feature for the Fairbanks station is incorporated in the same manner as presently in place for the Wallops station. This effort shall include the provision of interface hardware (PIU cards, cables, patch panels, modems, etc.) as required.
- Provide maintenance for the TDFS hardware for two simulators, two command encryption modules (CEM), and four SCP234 flight computers.
 - Replace obsolete Aeon RtVAX single board computers and Greenspring SBC4 boards in two simulators
- Provide configuration management for the simulator hardware at LMSSC and NOAA/SOCC.
- Provide simulator software and hardware support during launch-related activities.
- Provide support for monthly TTS Working Group and SDVF Issues Group meetings.

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The contractor shall provide all activities necessary to maintain and calibrate the Government-provided Environmental Data Recorder (EDR) units. The contractor shall install the EDR into the spacecraft shipping container for all spacecraft shipments and, as directed, into the instrument shipping container for outbound shipments of flight hardware instruments to instrument contractors and shall ship the EDR unit to instrument contractors for use during in-bound instrument shipments. The total number of shipments will not exceed 100 shipments. The Government will be responsible to verify GFE vendor containers will accommodate an EDR unit.

The environmental data recorder units (3) shall be calibrated annually, not to exceed 27 total EDR unit calibrations.

For each shipment using the EDR unit, the contractor shall provide and be responsible for all data reduction. The contractor shall provide the reduced data to GSFC as stated in the contract delivery schedule, in the number of copies and to the individuals specified below:

Distribution of Data for Shipment of Instruments

# Copies	Individual
1	Tiros Verification Manager, A Arman
1	Instrument Technical Officer
1	Instrument Systems Manager
1	Tiros Deputy Project Manager

Distribution of Data for Shipment of Spacecraft

# Copies	Individual
1	Tiros Verification Manager, A Arman
1	NOAA-L, N Observatory Manager, A Unger
1	NOAA-K, M, N= Observatory Manager, M Tasevoli
1	Tiros Deputy Project Manager

**10.11 MULTI-PROCESSOR SOFTWARE DEVELOPMENT FACILITY (MSDF)
HARDWARE MAINTENANCE**

The contractor shall provide maintenance for the MSDF hardware. Maintenance shall continue until the new flight software development facility on the Tiros Dynamic Flight Simulator is fully qualified to support the NOAA-K,L,M,N, and N= spacecraft.

10.12 NOAA-POLAR ACQUISITION AND CONTROL SYSTEM (PACS) REMOTE WORKSTATION

The contractor shall provide the following at the spacecraft I&T facility:

1. A secure location with cipher lock to accommodate the PACS workstation, plotter, and network hub device provided as GFE.
2. Data circuits and end equipment necessary to provide connection between the GFE T1 interface at the facility and the local PACS hub device.
3. A telephone at the workstation location.
4. Maintenance of the GFE PACS hardware.
5. Training on the basic operation of the workstation and plotter and support to resolve system problems. Tiros PMO system engineering staff shall be knowledgeable in the use of this equipment for observation and/or plotting of on orbit satellite data.
6. Security Plan for Workstation Access and Usage.

10.13 SOFTWARE DEVELOPMENT AND VERIFICATION FACILITY (SDVF)

The contractor shall utilize a workstation-based Software Development and Verification Facility (SDVF) to accomplish flight software development and maintenance. The development element shall at a minimum include an assembler, a linker/loader, and a configuration management tool. The verification element shall be based on the TDFS which shall be upgraded as necessary.

11 INTEGRATION AND TESTING

The contractor shall provide all necessary facilities and resources to integrate the various spacecraft components, subsystems and GFP and shall carry out the necessary testing and data analysis to verify satisfactory satellite performance for the NOAA-K, L, M, N, and N-prime .

The contractor shall update and resubmit a detailed plan for spacecraft integration and test.

The detailed integration and test procedures shall be updated when necessary by the contractor. New or updated procedures shall be submitted to the GSFC technical officer for review at least 15 days prior to implementation.

11.1 INITIAL INTEGRATION AND TESTING

The contractor shall integrate the flight components and subsystems and GFP instruments, less age sensitive components into each of the three spacecraft. Initial integration and test shall include but not be limited to mechanical assembly, harness and component installation and electrical checkout, proof and leak test of the RCS, initial power turn-on and functional check, detailed electrical test of the components and subsystems, including verification of all commands and telemetry, and other tests appropriate to demonstrate system operations including a full SEPET test.

11.1.1 IPF/DET Testing

The contractor shall perform Initial Power Functional (IPF) and Detailed Electrical Testing (DET) on each component box and subsystem after it is initially installed on the spacecraft. Such testing shall verify that the component under test meets its appropriate interface and operational requirements and will not harm other spacecraft components when spacecraft power is applied.

11.1.1.1 Automated Test Upgrade - (N/N-prime)

The contractor shall develop and perform IPF/DET tests using automated test procedures in a PC-based Lab Windows, or equivalent automated test system. The upgrade shall include capabilities for digital signal processing, digital filtering, statistics, and numerical analysis. The contractor shall develop and implement these automated procedures no later than the start of the NOAA-N Bus integration.

11.2 GFE-INSTRUMENT OPERATIONS

The satellite/GFE integration consists of those tasks required in receiving, testing, mounting, aligning, and functionally verifying the proper operation under ambient conditions of the GFE payload with the spacecraft. The GFE payload is defined as the compliment of sensors and tape recorders required for each satellite. The spacecraft must accommodate the mechanical, thermal, and electrical requirements of the GFE payload items. Table 2 in GSFC-S-480-25.1 lists the payload planned for NOAA-K, L, M, N, and N-prime. The interface specifications are listed in GSFC-S-480-25.1 under the applicable documents section.

11.2.1 Inspection and Bench Testing

Except as indicated in section 19.0, the contractor shall be responsible for accommodation of instrument bench check equipment, the appropriate instrument incoming inspection when it is received and providing support for the necessary instrument bench check testing and/or in conjunction with Government representatives the data evaluation. The contractor shall document all test anomalies and participate in GFE contractor and NASA planning for disposition.

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All payload tests shall be performed at the contractor's plant and the contractor shall provide all necessary facilities for those operations. Cleanliness, space, power, and standard test requirements for each payload item shall be provided by the contractor as defined in each Unique Instrument Interface Specifications.

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Incoming receiving tests shall consist of visual inspections, mechanical dimension checks, and data package review Bench tests shall be as defined in the UIIS.

Upon completion of the bench tests, the GFE shall then be integrated onto the spacecraft or placed in storage.

11.2.2 GFE Storage

Subsequent to incoming inspection and bench testing and prior to integration on the spacecraft, the GFE instruments DTR's, and Solid State Recorders (SSRs) shall be stored by the contractor as specified in each UIIS.

11.2.3 Payload Integration

The contractor shall be responsible for the integration of all GFE instruments and shall include the necessary IPF and DET testing of the instruments as specified in the appropriate interface documents. The contractor shall be responsible for the generation and maintenance of the appropriate test procedures used in this testing.

The contractor shall be responsible to perform annual proof test and inspection of all instrument lifting fixtures. Contractor shall assist GSFC in development of the requirements/procedures to be used in performing the annual test.

11.2.3.1 Mechanical Interface

The mechanical outline and mounting dimensions for the GFE payload items are shown in the referenced UIIS. The integration contractor shall provide all necessary shims and mounting hardware. Verification measurements to assure alignment and proper torque values shall be performed as detailed in the test procedure. Torque wrench calibration verification (by quality assurance) is required at installation.

11.2.3.2 Fields of View

The optical, RF, and thermal fields of view (FOV) requirements for each of the GFE payload items are contained in the UIIS. Analysis shall be made to determine that the fov for each instrument and spacecraft attitude sensor is clear of obstruction.

11.2.3.3 Electrical Interface

The electrical interface drawings for the GFE payload items are contained in the UIIS.

All electrical parameters as called out in the appropriate UIIS shall be measured. Selected parameters (as indicated in the UIIS) shall be monitored throughout the integration and test phases to determine continued acceptable performance.

11.2.3.4 Thermal Interface

The thermal interface requirements for the payload items are contained in the respective UIIS.

The contractor shall be responsible for the proper installation of thermal blankets, conductive thermal materials, thermal coatings, shields, sunshades, and louvers, except those installed on GFE as delivered. Radiator area sizes shall be checked prior to installation. Heater and thermistor locations shall be checked where possible. TCE set points and heater and louver operation (passive and active during thermal vacuum testing) shall be verified. The electrical power to each instrument shall be measured.

11.2.3.5 Data Evaluation

The data evaluation requirements for each of the payload items are contained in the respective UIIS. The contractor shall be responsible for obtaining and analyzing all required payload data throughout the testing program to ensure proper instrument operation and to check calibration. Data review will be accomplished by a joint Government and contractor team.

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The contractor shall provide ambient AVHRR visible targets as described in the UIIS Additional instrument targets will be GFE The contractor shall provide mounting structure and any associated materials.

11.2.4 ARGOS-II Calibration

If required, the contractor shall temporarily remove each ARGOS-II from its associated spacecraft for the purpose of recalibration by CNES just prior to the start of the environmental test flow.

11.3 SPACECRAFT SYSTEM TEST PROCEDURES

The contractor shall conduct formal qualification of the NOAA-K and flight acceptance testing of the NOAA-L M, N, and N-prime spacecraft in compliance with the requirements of GSFC-480-25.1.

11.3.1 SEPET

The Spacecraft Systems Electrical Performance Evaluation Test shall be as described in GSFC-S-480-25.1.

A full SEPET shall be required at the following places in the spacecraft integration and test flow.

1. Prior to the start of acceptance testing after the full complement of spacecraft boxes and instruments are installed.
2. In thermal-vacuum testing; at least once at each temperature plateau for NOAA-K & L. For NOAA-M, N & N', a full SEPET is required at least once at the hot plateau and at least once at the cold plateau.
3. Prior to mechanical vibration/acoustic testing.
4. Prior to shipment of the spacecraft to WR.
5. At the launch operations site

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11.3.2 Aliveness

The Spacecraft Aliveness Test shall be as described in GSFC-S-480-25.1.

Aliveness testing shall be performed at the following places in the integration and test flow:

1. Prior to environmental testing.
2. Between each axis or stage of vibration/acoustic testing.
3. Prior to shipping to the launch site with flight batteries installed.
4. At the launch site before and after transportation of the satellite to the launch pad.

11.4 PRE-ACCEPTANCE SPACECRAFT EVALUATION TEST

All-up spacecraft testing shall commence at the completion of the CFP payload integration effort. The contractor shall conduct all-up spacecraft evaluation testing of the five flight spacecraft to verify compliance with the requirements of GSFC-S-480 25.1. This shall be done by performing a complete system evaluation test (SEPET) prior to the beginning of the acceptance test program.

11.5 FACILITY READINESS

The contractor shall be responsible for facility readiness for the satellite integration and functional testing as well as environmental, acceptance and pre-ship testing. Systems engineering shall establish that facility requirements and through engineering evaluation establish that facilities meet the spacecraft test requirements (including the Government facilities at WR).

11.6 SATELLITE ACCEPTANCE TESTING

After satisfactory completion of the spacecraft inspection and system evaluation tests and the appropriate readiness review by the Government, the spacecraft will be allowed to continue into the acceptance test program.

The contractor shall conduct a formal acceptance test program of the NOAA-K, L, M, N, and N-prime spacecraft in accordance with GSFC-S-480-25.1 to verify compliance with the specified performance requirements. The test program shall be designed to demonstrate end-to-end satellite performance in all modes and environments practicable with the satellite configured as closely as practical to its orbit and launch configurations. The use of intermediate stimuli, the evaluation of intermediate data, and the use of non-flight configurations shall be minimized.

11.7 ACCEPTANCE TEST PROGRAM

The spacecraft acceptance test program shall consist of the following tests as required and specified in GSFC-S-480-25.1:

1. EMC/EMI/RFI Evaluation Test
2. Thermal Vacuum Performance Test
3. Test of Deployables
4. Mechanical Alignment
5. Vibration Testing
6. Model Testing (one structure only)
7. Acoustic Exposure Test
8. Mechanical/Operational Shock Test
9. RCS Leak Check
10. Power System Illumination Test
11. Weight and C.G. Measurement
12. Solid Rocket Motor Interface Verification

During the satellite integration and acceptance test flow the contractor shall verify the spacecraft/rocket motor interface using a rocket motor mechanical model. Electrical interface with the rocket motor shall also be verified.

11.7.1 Ground Station Compatibility Test Support

The contractor shall provide all necessary support for the spacecraft RF link compatibility testing with compatible ground 106 system equipment. This ground system equipment shall include the NASA Compatibility Test Van (CTV) and the JPL/DSN Compatibility Test Trailer (CTT), except for NOAA-M. The CTV, operated by GSFC Government and contractor personnel, will be at the contractor's facility for a minimum of 1 week during the thermal vacuum test. The CTT will be at the contractor's facility for a minimum of 1 week for Hi-Bay testing sometime during the spacecraft environmental test phase. Compatibility test procedures shall be written by the contractor to support the requirements as set forth by the Van and Trailer operators, and shall be reviewed by both NASA and the contractor at least 1 month prior to the start of test operations.

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The Contractor shall provide the necessary support for NOAA-K, L, M, N, and N-prime spacecraft baseband testing of commands originating at the NOAA/SOCC and terminating with the successful acceptance by and, where appropriate, execution by the spacecraft. This effort will demonstrate both clear and encrypted mode command capability of the NOAA/PACS.

The Contractor shall provide, at his facility, the necessary hardware, software, test procedures, and personnel required to support this premission verification of the operational integrity of the ground system.

For NOAA-K there will be six (6) separate and distinct tests performed. NOAA-L and NOAA-M there will be three (3) tests for each spacecraft and for NOAA-N and NOAA-N' there will be two (2) tests for each spacecraft. Each test is estimated to require 12 hours and will be performed in two 6 hour segments. Segment 1 will perform the testing using the TDFS to verify the "test script." Segment 2 will perform the testing with the spacecraft.

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Notification by the Contractor to the Government that a test period has been identified shall be made five working days in advance.”

This verification shall include a series of commands, to be sent from the SOCC to the spacecraft, which accomplish the following objectives:

- | | |
|------------------------|---|
| 1. Encryption | Demonstrate the ability to configure and operate the spacecraft in any clear and/or encrypted mode of operation. Exercise entry into and out of full and partial (1 side clear) encrypted modes, change keys, reset VCCs. Investigate interactions between PV, TV, CV, and VCC. |
| 2. General Load | Demonstrate the ability to load and measure timing of 5K or greater GENLD to a CPU in both clear and encrypted modes. |
| 3. On Board Processors | Load an entire CPU in the clear mode. |
| 4. Ephemeris | Demonstrate ability to perform ephemeris loads in both command modes. |

11.8 SPACECRAFT STORAGE

The NOAA-K, L, M, N, and N-prime satellites shall be prepared for and placed into storage after acceptance testing unless a launch call-up has been issued (see section 11.9.1). All spacecraft shall be prepared for/placed into storage no-later-than the dates as stipulated in Contract Attachment 3. Storage duration for each spacecraft is that period of time between the storage date and the planned launch date, as provided in Contract Attachment 3.

The contractor shall provide a satellite storage plan and shall submit the plan to GSFC for review. The storage plan shall include:

- ! Details of the satellite configuration during storage
- ! Details of storage environment and continuous monitoring of critical environmental parameters in the storage areas
Satellites in storage shall be evaluated and exercised approximately every 9 months. The exact time of evaluation will depend on ATNAGE availability and other programmatic considerations. The evaluation tests shall consist of telemetry data analysis, and the exercise of electromechanical devices where required to maintain functional readiness. Anomalies detected during storage tests shall be properly documented (TDR's etc.). Immediate repairs may not necessarily be made.
- ! Provisions for removing GFE payload and satellite components for bench test and/or refurbishment.

11.9 PRESHIPMENT PREPARATIONS

11.9.1 Call-up for Launch

Upon determination by the Government that a spacecraft launch is required, a call-up letter/fax will be issued to the contractor. Upon issue/receipt of said call-up, the spacecraft called up shall be prepared for shipment, shipped to the launch site, and processed for launch (see section 12). The contractor shall provide a Nominal spacecraft flow such that from issue/receipt of said call-up through launch shall not exceed 150 calendar days. Any directed spacecraft reconfiguration(s), included in the call-up notification, may extend the nominal call-up period. Failure to receive a call-up does not relieve the contractor from responsibility to meet the requirements of section 11.8.

11.9.2 Flight Battery Preparation

Flight battery preparation for final spacecraft installation prior to launch shall be in accordance with the ATN Battery Handling Plan. This plan shall be modified as necessary and maintained by the contractor. The plan shall include but not necessarily be limited to the fabrication flow and schedule-timing relative to spacecraft call-up, storage, activation, and testing details, precautions and protections (cover, etc.) of the flight batteries, the conditioning requirements and special

flight battery handling during spacecraft turn-on, battery charging and other tests at spacecraft level, battery parameters to be monitored, and general physical handling and requirements during periods of inactivity on and off the spacecraft.

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The plan and schedule of operations shall be submitted to GSFC for review and approval 6 months after receipt of contract.

11.9.3 Solar Array Preparations

The contractor shall prepare, maintain, and implement a solar array handling plan. It shall include but not be limited to storage requirements prior to call-up, inspection intervals and details (magnification, etc.), electrical evaluation including illumination tests, the cleaning procedures required prior to shipment, and all handling precautions and protections (covers, etc.) to be used before and after installation on the spacecraft.

The plan and schedule of operations shall be submitted to GSFC for review and approval 6 months after receipt of contract.

11.9.4 Preshipment Testing and Cleaning

The contractor shall conduct preshipment tests of the satellite to reverify proper performance. The results of these test shall be compared with pre-storage test data to determine system trends. Preshipment tests shall include but not necessarily be limited to the following:

1. IMU Alignment after reinstallation.
2. Battery Conditioning and Capacity Testing.
3. Pre-shipment Launch Site SEPET

Final factory inspection and cleaning, as required, shall be performed on all external surfaces of the spacecraft

11.9.5 Pre-shipment IMU Preparations

Parameter verification testing and calibration check of the Inertial Measurement Unit (IMU) shall be performed within 240 days of the launch date and as close to the shipment date as is practical to allow for launch date slip contingency.

11.10 Hardware Changes/Regression Testing

The contractor shall change out the MHS 1553 Bus, Power, and Signal Harnesses to mitigate EMI concerns involving the MHS instrument and the spacecraft subsystem MIU on NOAA-N and NOAA-N'. The contractor shall perform the appropriate regression testing to return the spacecraft to its pre-harness change out state.

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12 LAUNCH SUPPORT

After satisfactory completion of all spacecraft acceptance testing and the appropriate readiness review by the Government, the Government shall allow the spacecraft to be shipped to the Western Range (WR) for launch operations.

The contractor shall provide, updated when necessary by the contractor for each launch, the test plans and launch operations test procedures as well as test and data evaluation support for all WR testing and shall perform all satellite associated tasks required for launch operations as specified in the Spacecraft Launch Operations Handbook (LOHB).

12.1 TRANSPORTATION TO WR

The contractor shall package the flight satellite and all necessary AGE for transportation to WR with as little as possible disassembly. Satellite shipping containers for NOAA-K, L, M, N, and N-prime whether existing, modified existing or new shall be provided by the contractor. The packing plan shall be contained in the LOHB for NOAA-K, L, M, N, and N-prime.

12.1.1 Spacecraft Transportation

The contractor shall transport the satellite from the contractor's facility to the airstrip or other location designated by GSFC. GSFC will be responsible for procurement of the aircraft and any necessary air transportation certificates and waivers. The contractor shall provide all necessary hazardous material documentation for aircraft transportation. The contractor shall provide the necessary equipment and manpower to support the loading and unloading of the aircraft and the transportation from the airstrip to the spacecraft processing building at WTR. The contractor shall provide manpower to support the transportation of the spacecraft from the spacecraft processing building to the launch pad. The contractor shall monitor the shipping environment for all controlled conditions; shock, temperature, humidity, container pressure while the satellite is in the shipping container and shall support any additional monitoring that the Government decides to implement.

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The transportation plan shall be included in the LOHB.

The contractor shall maintain a log of events and periodic environmental readings throughout the transportation. The time of significant and major events, and unexpected environmental readings shall be recorded. All unexpected events shall be evaluated for their possible negative impact on the spacecraft and a DR shall be generated if it is considered to possibly impacting spacecraft performance.

The contractor shall conduct a preshipment coordination meeting with the shipment handling personnel at the west coast airport terminal.

12.1.2 AGE Transportation

The satellite contractor shall package the AGE, exercising reasonable packing precautions, for shipment from his plant to WR and return. Shipment will be by Government Bill of Lading.

The contractor shall reassemble as required and checkout all AGE after each shipment, verifying that they are all operating within normal specification limits before their use with the spacecraft. The contractor shall utilize previously developed, tested and approved AGE performance tests. Equipment not meeting specification shall be repaired as needed to assure proper performance.

12.2 LAUNCH SITE OPERATIONS

The contractor shall be responsible for the assembly and test of the integrated satellite system, all contractor supplied AGE, and support of the launch vehicle contractor during combined launch vehicle and satellite pre-launch testing.

12.2.1 Spacecraft Mechanical Operations

NOAA-K,L,M

The contractor shall be responsible for the following mechanical operations at WR:

1. Removal of the spacecraft from its shipping container, and subsequent post shipment inspection, and protective covering of the spacecraft.
2. Preparation and inspection of the spacecraft-to-launch vehicle adapter and of the solid rocket motor.
3. Mating of the spacecraft with the solid rocket motor and the launch vehicle adapter.
4. Leak check of the spacecraft reaction control system with N2 and He.
5. Pressurization of the reaction control system and leak checking of the system.
6. Launch pad alignment facility verification check and spacecraft alignment check on the launch pad.

The contractor shall be responsible for performing satellite vehicle applicable tasks necessary for the preparation and launch of NOAA-KLM on the TITAN-II vehicle as defined in the TITAN-II ICD-TII-25004, dated 7/18/89 through Revision 6, dated 2/10/95 and ICNP-J, dated 12/6/95 and ICNP-K, dated 12/8/95.

The transportation to the launch pad, mating with the launch vehicle, and encapsulation on-stand will not be the responsibility of the contractor. However, consultation and limited review of these operations will be required.

NOAA-N and N-Prime

The contractor shall be responsible for the following mechanical operations at WR:

1. Removal of the spacecraft from its shipping container, and subsequent post shipment inspection, and protective covering of the spacecraft.
2. Preparation and inspection of the spacecraft-to-launch vehicle adapter.
3. Mating of the spacecraft with the launch vehicle adapter.
4. Leak check of the spacecraft reaction control system with N2 and He.
5. Pressurization of the reaction control system and leak checking of the system.

The contractor shall be responsible for performing satellite vehicle applicable tasks necessary for the preparation and launch of NOAA-N and N-prime on the Delta II vehicle as defined in the Delta II National Oceanic and Atmospheric Administration – NN' (NOAA-NN') Mission Specifications(s). NOAA-N-prime TBD.

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The transportation to the launch pad, mating with the launch vehicle, and encapsulation on-stand will not be the responsibility of the contractor. However, consultation and limited review of these operations will be required.

12.2.2 Spacecraft Electrical Testing

The contractor shall be responsible to perform the following spacecraft electrical operations at WR.

12.2.2.1 Launch Site SEPET

The contractor shall perform Launch Site SEPET per GSFC-S-480-25.1 to verify the adequacy of the satellite for launch. This shall be performed following satellite mechanical preparations.

12.2.2.2 Spacecraft/Launch Vehicle Interface Test

NOAA-K,L, and M

The contractor shall perform a test to demonstrate spacecraft readiness for sensing liftoff and for receiving separation discretes from the launch vehicle.

NOAA-N and N-Prime

The contractor shall perform a test to demonstrate spacecraft readiness for receiving separation discretes from the launch vehicle.

12.2.2.3 Accelerometer Check (NOAA-K,L,M only)

The contractor shall perform a test of the readiness of the IMU accelerometers. The IMU accelerometer readiness test may be performed either at the launch site or at the factory.

12.2.2.4 Launch Site Satellite Aliveness Test

A satellite aliveness test shall be performed after mating to the booster at the launch pad, prior to encapsulation, in order to verify that no satellite failure has occurred as a result of the transportation to the pad and the mating to the launch vehicle.

12.2.2.5 Flight Readiness Test

A Flight Readiness test shall be performed with the satellite on the booster in flight configuration (except all squibbs shorted). This test will verify that the RF links from the satellite to AGE are not degraded and that the satellite demonstrates proper operating performance when exposed to the RF generated by the launch vehicle airborne transmitters and range transmitters.

12.2.2.6 IMU Alignment Test (NOAA-K,L,M only)

A total flight simulation of the ascent guidance program (using artificial IMU outputs) shall be required using the actual NOAA Spacecraft mission constants. This test shall also exercise the ascent telemetry system and shall be performed with all hardware in the launch configuration.

12.2.2.7 Battery Conditioning

The contractor shall provide for maintenance and proper conditioning of the satellite batteries throughout the period following removal from cold storage for installation on the satellite through launch site operations. The flight batteries shall be reconditioned, as a baseline, every 30 days after removal from cold storage. The time lapsed between to "final" reconditioning and the launch shall be minimized. In the case of a launch delay, the contractor may be directed to perform a battery reconditioning Aon stand. This shall be accomplished by initiating one reconditioning discharge/drain operation just prior to moving the Spacecraft from Building 1610 to the launch pad.

12.2.2.8 Ordnance and Ordnance Circuit Verifications

The electrical parameters and proper operation of all ordnance circuits (pyros shorted) shall be verified before transportation to the launch pad and at the launch pad.

12.2.2.9 Solid Rocket Motor Arming and Safing (NOAA-K,L,M)

The contractor shall perform a test to verify that the NOAA-K,L, and M electrical interface to and circuitry of the solid rocket motor arming device operates properly.

12.2.3 Launch Site AGE

The contractor shall design, fabricate, install and test all satellite and AGE hardware necessary to interface with the launch vehicle and the launch complex. The contractor shall verify compatibility with the launch pad umbilical and block house equipment.

The launch umbilical shall be supplied by the launch vehicle contractor.

For NOAA-N and NOAA-N', provide a remote block house equipment configuration for the launch site equipment as required by the Delta II Program.

12.2.3.1 AGE Power Supply and Umbilical Compatibility Test

A ground power supply, launch tower cable, and umbilical harness test shall be performed to verify the compatibility of the ground power supply and the interface from the block house to the launch pad required for launch operations.

For this test the launch umbilical should be terminated with the LSE test box and the various electrical load and power modes should be simulated to evaluate the system line losses and impedances and overall operation.

12.2.4 Establishment of RF Links and Voice Communications

The Government will furnish all communications facilities between the launch pad and the ATNAGE and between the spacecraft test building and the ATNAGE and voice communications to the local and world networks and the Launch Operations Building.

12.2.4.1 AFSCF Compatibility Test

The contractor shall support a test to demonstrate compatibility of the 2247.5 MHz downlink with the AFSCF Vandenberg remote Tracking Station (VTS). The test shall include data flow from the satellite RF link through the VTS to the Satellite Test Center (STC) at Sunnyvale and from there to NOAA/SOCC.

The contractor shall verify that the operation of communications are functioning adequately to perform operation.

12.2.5 Thermal Systems Requirements

The contractor shall be responsible for the following:

1. Inspection and cleaning where necessary of thermal control surfaces.
2. Removal of protective strippable coatings.
3. Inspection and correction of defects in thermal coatings, conduction control materials, thermal blankets, sun shades, louvers, and radiating areas.
4. Visual verification of louver blade angles.

12.2.6 GFE Payload Final Preparations

Final preparations for each GFE payload item shall be performed as called out in each UIIS .

12.2.7 Final Flight Software and Data Load Verifications

12.2.7.1 Flight Load Package (FLP)

The contractor shall assure that both spacecraft computers contain the FLP with the correct code and mission constants data for launch by performing and reviewing a verification dump of each computer after completion of the final on-board computer load.

12.2.7.2 Launch Ephemeris Table

The ephemeris table for launch will be supplied by the Government (NOAA/NESDIS) and shall be verified by the

contractor. The launch table shall be tested in the GEODAT simulator by the contractor, with the sun-moon warnings, the solar array drive information, and the magnetic latitude information verified for 14 orbits of operation. The contractor shall be responsible for loading and verifying the load of this launch ephemeris table in support of launch site operations.

12.2.7.3 Ascent Guidance Software#(AGS)

In addition to the verification of AGS code and the spacecraft mission constants, the contractor shall utilize the results of the AGS simulation performed in the IMU Alignment Test to further verify AGS flight readiness.

12.2.7.4 Stored Command Table

The stored command table will be supplied by the Government and shall be verified by the contractor. The contractor shall be responsible for loading and verifying the load of this stored command table in support of the launch site operations.

12.2.8 Real-Time Data Processing for Launch and First Orbit Pass

The contractor shall prepare the ATNAGE hardware and software to receive TIP data from designated available GFE sources during launch phase until loss of signal. Loss of signal, assuming ARIA coverage, is scheduled to occur no earlier than completion of the velocity trim maneuver. The contractor shall use this data to:

1. Provide initial, real time orbit element estimate to the SOCC and GSFC;
2. Provide status and occurrence of ascent events;
3. Provide history of all telemetry received;
4. Strip and transmit significant TIP data to the SOCC as received;
5. Provide initial state of the satellite to the SOCC and GSFC; and
6. Provide real-time display of the spacecraft computer telemetry.

The contractor shall receive (from GFE source), record, and provide processing, display, interpretation, and selective printout of the WR first-pass orbit data and launch tape recorder data dump.

Termination of the launch support shall be issued by the SOCC after the first pass assuming nominal orbit and satellite operation are achieved.

12.3 PROPULSION SYSTEM LOADING EQUIPMENT, PERSONNEL AND PROCEDURE REQUIREMENTS

All discussions in sections 12.3.x referencing hydrazine and hydrazine related topics shall be applicable to NOAA-K, L, M only.

All procedures are subject to review by NASA/GSFC and all procedures and equipment for use at WR must meet the applicable safety requirements and the procedures must be reviewed and approved by the responsible WR safety organizations (AF and/or NASA as applicable) prior to their use.

Test and flight pressurant gases and fluids required to perform the WR hydrazine operations will be provided by the Government. Analysis of the hydrazine samples will be performed by the AF chemistry laboratory at WR.

The hydrazine procedures shall be designed to minimize the quantity of hydrazine requiring disposal at WR. Strict containment of all waste shall be implemented. Control and disposal of waste shall be the responsibility of the Government.

12.3.1 Loading Cart and Associated Equipment

The GSFC will provide the propellant loading cart for N₂H₄ hydrazine loading operations. The Government shall also provide and maintain all necessary protective clothing SCAPE suits, safety equipment, pressurization equipment, hoses, fittings, unique loading equipment (for use with the PLC, spare parts, drums, etc.). The contractor will maintain the cart for operations as required.

In addition the contractor shall:

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1. Provide and perform as required, all procedures necessary for the hydrazine sampling, loading, unloading, emergency off-load, and pressurization of the propulsion system at WR.
2. Generate, maintain, and perform all necessary procedures to service, maintain, calibrate, and checkout the PLC and its associated equipment.
3. Perform a documented checkout of the PLC prior to use.
4. Prepare, kit, and deliver to WR in ready to use condition, all equipment needed to perform WR operations.

12.3.2 Scape Suits

The Government shall provide SCAPE suits and service the suits and provide the necessary communications services during the hydrazine handling operations.

12.3.3 Personnel Requirements

The contractor personnel assigned to the hydrazine fueling operations shall be trained and qualified to perform their tasks in accordance with all applicable USMC regulations governing this work. Prior to USMC operations, all hydrazine handlers shall be:

1. Medically examined and certified.
2. Trained and qualified to work in SCAPE suits through a Government training program.

12.4 CONTROL OF STATIC PRODUCING MATERIALS

The contractor shall provide necessary equipment to remove static from any tapes or other static prone materials that must be used on the spacecraft. In general, materials subject to static buildup shall be prohibited from use on or around the spacecraft.

12.5 LAUNCH ACCOUNTABILITY BOARD

The contractor shall be responsible for providing a launch accountability board which shall have a blank place for each piece of non-flight equipment to be removed prior to launch. Photographs of the board, clearly showing each item removed, shall be taken by the contractor and given to GSFC prior to mating the spacecraft to the launch vehicle and prior to launch.

12.6 SPARE PARTS

Spare parts shall be identified and a list provided to GSFC as back up for each launch.

12.6.1 Spacecraft Antennas and other Flight Items

12.6.2 Flight Plugs

A spare set of flight enable plugs shall be readily available at WR in case of damage or loss of the assigned flight plugs. All flight plugs shall be verified as wired properly and operating correctly before use.

12.6.3 AGE Spare Parts

AGE spare parts shall be identified and a list provided to GSFC to back up each launch.

13 HARDWARE/SOFTWARE MAINTENANCE

13.1 GFE MAINTENANCE

GFE Maintenance shall be provided in accordance with the schedule of the contract.

13.2 GROUND S/W MAINTENANCE AND GROUND HARDWARE CALIBRATION

Ground S/W Maintenance and Ground Hardware Calibration shall be provided in accordance with the schedule of the contract.

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14 SATELLITE ACTIVATION AND EVALUATION

14.1 DEFINITION AND OBJECTIVE

The activation and evaluation (A&E) mode of satellite operations consists of the operations and tests necessary to measure the satellite performance, investigate unusual or unexpected conditions, and activate the satellite systems to place them in a defined state suitable for the operational mode.

The objectives of the activation and evaluation period are:

1. Provide engineering performance evaluation of all subsystems, modifying documentation where necessary to reflect in-flight information, and feeding back information applicable to future satellite design;
2. Assure that the operational plans and prelaunch analysis are consistent with in-flight realizations by temporarily providing satellite design experts to analyze data and advise operations personnel; and
3. To activate the satellite into operational mode with a documented well defined state of each system, for turn-over to NOAA for operational environmental use.

The contractor shall provide pre-launch support to the operations crew to include procedure and database updates and review, flight software changes, etc., as required to prepare for A&E of the satellite.

The contractor shall provide engineering and support personnel and management structure to participate in the phase of A&E called launch and early orbit (LEO). This period nominally lasts from launch through spacecraft orbit #60 when major satellite subsystems should be in a normal operating mode.

These additional personnel shall provide satellite design expertise, data analysis, and operations recommendations to NASA and the Operations Directors specifically for evaluation and resolution of unusual or unexpected conditions and to establish baseline parameters for major subsystems operations. NASA will select Operations, Test, and Assistant Test Directors from appropriate NASA, NOAA, or satellite contractor personnel to support each shift during the LEO period. Instrument engineering support will be provided by the Government

For NOAA-K only, contractor on site support at the SOCC is required for a full week after launch for those disciplines shown in the table below. After the first week through the end of the 60 day checkout period, the discipline engineers shall be on call at the contractors plant to assist in any spacecraft analysis or subsystem performance characterization as needed in support of NOAA-K on orbit checkout. This support is estimated as two hours per day per discipline for 53 days. In addition, two contractor systems engineers are required on site at SOCC for 8 hour day shifts throughout the 60 day NOAA-K checkout period. At times, the systems engineers may be replaced by discipline engineers, such as ADACS and power.

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The contractor support for a nominal pre-launch and LEO period shall be structured as follows:

Assignment	Proc and Database Review	Simulation and Dress Rehearsal	Prelaunch Preps	Post-Launch Ops			
				Day	Night	Day	Day
Note	4, 6, 7, 9	1, 6, 8, 9	1, 6, 9	2, 6, 9	2, 6	3, 6	5
ADACS	X	X	X	X	X	X	X
C&Cs	X	X	X	X	X	X	X
DHS	X	X	X	X	X	X	X
Comm	X	X	X	X	X	X	X
Power	X	X	X	X	X	X	X
RCE	X	X	X	X	X		
Deploy	X	X	X	X			
S/W	X	X	X	X	X	X	X
Thermal	X	X	X	X	X	X	X
TechConsul						X	X
Test Dir	X	X	X	X	X	X	X
Site Mgr	X	X	X	X			
S/W Mgr			X	X	X		

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- Note:
1. All personnel
 2. 13-hour shift, launch thru L+48 hours
 3. 10-hour shift, L+48 hours thru L+100 hours
 4. 2 days, 1 person/discipline at SOCC
 5. For NOAA-K only, 10 hour shift, L+48 hours thru L+168 hours
 6. For NOAA-M only, Comm/DHS discipline are provided independently
 7. For NOAA-M only, additional 5 days per discipline for Level II NOAA Polar Acquisition and Control System database review at LMSSC
 8. For NOAA-M only, provided Flight Operations Team (FOT) support to 2 additional simulations, the first prior to spacecraft shipment to the launch site, the second following launch site SEPET.
 9. For NOAA-M only, Deploy is added as a separate discipline and support is provided through Launch Day 1.

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14.2 ACTIVATION AND EVALUATION PLAN

An activation and evaluation (A&E) plan for each satellite is developed by the Government. The plan includes detailed test, data, and evaluation requirements, command procedures, and the schedule for the operations and tests, including scheduling accommodations as supplied by NOAA regarding operational use of SOCC/CDA's for concurrent operational satellites. Upon request by the Government, the satellite contractor shall provide plan inputs detailing a nominal A&E for the major satellite subsystems exclusive of the instrument unique requirements, and review the final overall plan for correctness and completeness to prepare the satellite for its operational mode. The contractor shall recommend contingency procedures for non-nominal satellite operations and review for accuracy the contingency procedures document provided by the Government for each satellite.

14.3 ACTIVATION AND EVALUATION REPORT

The contractor shall provide a written report of the LEO portion of the activation and evaluation operations. The report shall provide a history of the activation and evaluation operations, description of problem areas in the planned operations, descriptions of work-arounds and suggestions for future plan improvements. The report shall document the performance evaluation of the launch vehicle and satellite subsystems during the launch activity and their effect on orbit attainment. The analysis of the boost-mode TIP telemetry tapes from the launch site ATNAGE equipment and tape recorded playback of the boost TIP telemetry shall be provided as well as the correlation of this information with the launch vehicle/telemetry and WTR tracking data for purposes of measuring satellite and launch vehicle performance and for anomaly investigation. The report shall document the performance measurement and evaluation of all satellite systems in the mission mode, detailing the degree to which subsystem performance is met or exceeds specification. The report shall provide the baseline of system performance for the operational mode, and any deviations to previously supplied operational procedures. Calibration data or other similar information shall be

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corrected and supplied. The A&E report shall be reviewed by the Government.

14.4 PERIOD OF ACTIVATION AND EVALUATION OPERATIONS

The activation and evaluation period for any satellite may require extension due to unusual circumstances such as non-nominal orbit, and satellite or ground equipment anomalies or malfunctions. Any such additional effort will be subject to a change issued under the authority of the changes clause.

14.5 PREPARATION FOR ACTIVATION AND EVALUATION ACTIVITIES

14.5.1 Prelaunch Simulation Data

Test tapes shall be generated during satellite integration and test to support SOCC simulations of the routine spacecraft operations of commanding and data receipt as well as special satellite activation and evaluation simulations. The contractor shall supply these tapes upon request from NASA.

14.5.2 Prelaunch Data Transmission

Satellite TIP data shall be transmitted from the ATNAGE to the SOCC ground systems during I&T, specifically during thermal vacuum but otherwise as required by NASA, utilizing the 9600 bps modem interface of the ATNAGE and GFE modems and lines. This shall be concurrent with testing, but on a non-interference basis.

14.5.3 Prelaunch Operations Information

Six months prior to launch the contractor shall provide a letter to NASA which details the following:

1. Instrument Complement.
2. Subsystem changes since the previous satellite.
3. Recommendation for changes to the launch stored table, LEO or A & E satellite checkout plans.

14.5.4 Prelaunch Spacecraft Operations Training

The contractor shall provide operations training in the form of two classroom presentations.

The initial training session(s), to be taught at LMSSC, shall provide a basic operational working knowledge and an overview of the mission, orbital mechanics, and spacecraft subsystems. Technical detail will be provided to the block diagram or functional flow level.

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The second training session(s), taught at the SOCC, will provide more in-depth spacecraft subsystems information. At a minimum, the session shall be designed to provide the SOCC personnel with the level of detail training on the spacecraft required to enable them to develop SOCC Operational and Contingency Procedures, perform day to day spacecraft assessments, and conduct anomaly resolution activities within the SOCC.

For NOAA-M only, prior to simulation and launch activities, attend one-day Flight Operations Team (FOT) training session at LMSSC to be provided by GSFC.

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15 SOCC/CDA STATIONS ENCRYPTING EQUIPMENT

The contractor shall design, and fabricate the CDA site equipment necessary to generate the encrypted/authenticated command signal for both NOAA ground stations (Wallops Island and Fairbanks, Alaska) and associated test equipment.

The contractor shall fabricate and deliver to the government two (2) additional command encryption modules (CEM) for use in the TIROS Dynamic Flight Simulators (TDFS). See GSFC-S-480-25.1, Paragraph 3.2.1.2 for CEM maintenance requirements.

The contractor shall support interface meetings associated with this equipment.

The contractor shall generate, with the assistance of NASA, the interface specifications for the above equipment and shall be responsible for the maintenance of the interface documentation.

Installation, documentation and on-site test support shall also be provided by the contractor.

The AGE supporting the satellite testing at the contractor's facility shall use functionally identical versions of this equipment for satellite checkout. This shall also be designed and fabricated by the contractor.

The above equipment shall meet performance criteria specified in GSFC-S-480-25.1.

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16 APOGEE KICK MOTOR AND HYDRAZINE (NOAA-K,L,M)**16.1 APOGEE KICK MOTOR (AKM)**

The contractor shall procure four AKM's one of which shall be a spare. The contractor shall be responsible for the type-selection and procurement of the solid rocket apogee kick motor (AKM) used for final orbit insertion. The motor shall be fabricated at the appropriate time to minimize effects of aging and be delivered for use at the launch site by the rocket vendor in timely coordination with launch operations. The motor shall conform to the specifications called for in GSFC-S-480-25.1.

The AKM items are:

		<u>Qty.</u>
Apogee Kick Motors		4(3 flight, 1 spare)
Mount Flange Modification		N/A
Nozzle Vibration Test		N/A
Documentation		Lot
Shipping Container Rental		3
Leak Test Fixture	1	
Mass Simulator		1
Support Equipment		Lot
Inert Motor		1

16.1.1 Storage and Control of the AKM's at WR

The storage and control of the AKM's at WR will be the responsibility of Government.

16.2 HYDRAZINE (N₂H₄)

The Government will be responsible for the procurement of the proper hydrazine for loading into the spacecraft during launch preparations and for testing of the REA's at the subcontractor's facility.

16.2.1 Hydrazine Storage at WR

The storage and control of hydrazine at WR will be the responsibility of the Government.

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17 PROBLEM RESOLUTION AND REWORK

The contractor shall perform, (and/or verify the performance of, in the case of subcontracted equipment) all activities associated with the resolution of failures and other performance anomalies associated with the hardware and software of components and systems of with flight and ground support equipment and facilities. This effort shall include all necessary investigations, corrective and preventative actions, analyses, rework, retest, and associated documentation and quality assurance.

The Government will be responsible for the rework of GFE flight hardware. The contractor shall be responsible for maintenance of basic discrepancy report documentation and reprocessing of the GFE to the spacecraft when it is received after rework is performed.

The Government shall be made aware and involved in the decision making for the removal, changeout of all spacecraft components.

17.1 DISPOSITION OF TEST DISCREPANCY REPORTS (TDR's)

TDR's (describing malfunctions in test and other significant discrepancies) shall be reported to the NASA Resident at the contractor plant within 24 hours of the occurrence.

The disposition of TDR's including the determination of the problem detailed description, its cause, corrective action, and future prevention shall be accomplished in a formal meeting (test review board (TRB)) with the participation from management, engineering, product assurance and designated government representation. No troubleshooting, retest, rework, or repair shall be accomplished without approval from the TRB.

The TDR closeouts shall be provided to the GSFC Project for review. In some instances, TDR's will require subcontractor action, or in the case of GFE, government action, to follow-up and resolve the discrepancy.

17.2 TEST OF REWORKED FLIGHT EQUIPMENT

Test of reworked flight equipment shall be in accordance with the Test Review Board direction.

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18 LAUNCH VEHICLE INTERFACE

18.1 Launch Vehicle Interface (NOAA-K,L,M)

Under separate contract with the Government, the launch vehicle contractor will generate all ascent parameters required to completely define the launch trajectory from liftoff until satellite separation, and will also provide all the requisite data and analyses in order to support the analysis and definition of the spacecraft ascent software by the spacecraft contractor, from separation through solid rocket motor firing and final handover to control in the orbit mode configuration.

The spacecraft contractor, through GSFC, shall establish the liaison and working relationships with the launch vehicle contractor required to accomplish these tasks.

Formal documentation of the ascent phase of the mission will be generated and presented to NASA/GSFC and all analytical tools such as computer programs referenced in this documentation shall be made available to NASA/GSFC if requested.

The spacecraft contractor shall perform the tasks necessary to modify the spacecraft to interface with the Titan II to accommodate the NOAA-K, L, M lift-off weight. This shall include support of interface meetings with the launch vehicle contractor, development and validation of a modified Ascent Guidance Software package, analysis and necessary development tests of the spacecraft structure.

18.2 Launch Vehicle Interface (NOAA-N and N-prime)

The spacecraft contractor shall perform the tasks necessary to modify the spacecraft to interface with the Delta II. The spacecraft contractor, through GSFC, shall establish the liaison and working relationships with the launch vehicle contractor to accomplish these tasks. The launch vehicle contractor will support the interface activity under separate contract with the Government. The launch vehicle integration tasks shall include, but not be limited to, the following:

- a. The spacecraft contractor shall support interface meetings with the launch vehicle contractor.
- b. The launch vehicle contractor will perform two complete coupled loads analyses based upon finite-element models provided by the spacecraft contractor, one before NOAA-N construction and the other after NOAA-N modal test.
- c. The spacecraft contractor shall assess the compatibility of the structure with the Delta II launch environment, including the acoustic environment. The spacecraft contractor shall identify portions of the structure, if any, that require modification to accommodate the Delta II launch environment. The spacecraft contractor shall design and implement the modifications.
- d. The spacecraft contractor shall compare the expected accelerations of non-GFE components with their qualification status. The spacecraft contractor shall implement re-qualification of non-GFE components that are found to be not qualified to the Delta II launch environment.
- e. The spacecraft contractor shall advise GSFC of the expected accelerations of the GFE components.
- f. The spacecraft contractor shall consult with the launch vehicle contractor to establish a mutually satisfactory method for coupling RF through the fairing. The launch vehicle contractor will implement the selected coupling.
- g. The launch vehicle contractor will provide a re-radiation system to support communications between the Mobile Service Tower (MST) and the ATNAGE II site for use during on-stand checkout.
- h. For each candidate WR tracking station that can interface with ATNAGE II, the launch vehicle contractor will plot and evaluate mission timelines that show link margins, using expected launch vehicle attitude and trajectory, and spacecraft/fairing antenna patterns.
- i. The spacecraft contractor shall review the mission timelines and shall recommend to GSFC an appropriate set of tracking stations for use in the launch.
- j. The launch vehicle contractor will determine the actual spurious emissions of the Delta II S-Band transmitters in the spacecraft command receiver receive band, and will make any changes in the transmitters necessary to meet the spacecraft command receiver susceptibility levels.
- k. The spacecraft contractor shall determine the actual susceptibility of the spacecraft command receivers to spurious emissions outside the receive band. If the determination confirms the specified susceptibility, the launch vehicle contractor will determine actual spurious emissions from its S-Band transmitters outside the spacecraft command receiver receive band. If neither determination shows that the actual emissions meet the actual susceptibility, the

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spacecraft contractor and launch vehicle contractor shall decide whether to add filtering to the transmitters or the receivers, and the corresponding party shall implement the decision on its hardware.

- l. The spacecraft contractor shall determine the actual tolerance of the spacecraft command receivers to the Delta II C-Band transmitter emissions, and shall make any changes in the spacecraft command receivers necessary to tolerate the Delta II C-Band emissions.
- m. The spacecraft contractor shall consult with the launch vehicle contractor to establish a mutually acceptable set of launch vehicle discretes in response to which the spacecraft initiates autonomous attitude control following separation and (if necessary) turns on its S-band transmitter at an appropriate time after liftoff. Each party shall implement the part of the decision that applies to its equipment.

19 GOVERNMENT FURNISHED PAYLOAD

The Government will provide as Government Furnished Property (GFP) all instruments, digital tape recorders, (DTRs), solid state recorders (SSRs), associated bench test equipment (BTE) and certain instrument targets.

For NOAA-K, L, M, N, and N-prime the contractor shall perform incoming inspections provide support for bench CCR
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tests and perform spacecraft integration tests on each instrument and recorder. The bench test shall be an MOD
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an abbreviated version of the instrument contractors final bench test results of which shall be supplied to the spacecraft contractor by the Government. The spacecraft contractor shall also provide for the routine calibration and minor maintenance of the GFE and CNES BTE standard test equipment that can be performed within his facility. Repair of the GFE payload and of the non-standard BTE will be performed by the Government Exceptions to the above are as follows:

1. Argos-II integration support, bench acceptance tests, and maintenance of the instrument and associated non-standard BTE will be provided by the French representatives.
2. DTR/SSR integration support, bench acceptance tests, and maintenance of the DTR's/SSR's and associated BTE will be provided by the DTR/SSR contractor

19.1 INSTRUMENT REPLACEMENT

The contractor shall be responsible for spacecraft operations, instrument inspection, instrument checkout, instrument storage, shipping and proper handling when it has been determined that instrument replacement is necessary. Instrument replacement and subsequent retest will be performed when directed in writing by the CO.

19.2 NPOESS INSTRUMENT ACCOMMODATION STUDY

The contractor shall study the accommodation of new instruments on NOAA-N'. Except for the instruments listed below, the baselined NOAA-N' payload is unchanged.

Cross-track Infrared Sounder (CrIS) replaces the HIRS

Ozone Mapper and Profiler Suite (OMPS) replaces the SBUV/SBUVE

GPS Occultation Suite (GPSOS)

The CrIS, OMPS, and GPSOS are Air Force procurements undergoing a competitive downselect. Data about these instruments must be handled in accordance with Air Force Conflict of Interest procedures.

The study shall address changing to CCSDS packetized telemetry for all digital telemetry, upgrading the C&CS and DHS subsystems, evaluating physical instrument accommodation options, providing for the on board storage and playback of full resolution data from both a 5 channel or a 6 channel AVHRR.

The contractor shall coordinate regularly with GSFC throughout the study through telecons, meetings, etc. Study products shall include mechanical layouts of the new instruments, mass property assessments, communications subsystem changes, updated C&CS and DHS concepts, flight software impacts, and detailed cost and schedule estimates for implementation. A report summarizing study results and implementation cost estimates shall be submitted in accordance with CDRL 125.

After CDRL 125 is submitted, the contractor shall begin the preliminary design of the instrument accommodation, concentrating on the data system. The initial preliminary design shall be presented in a technical interchange meeting.

19.3 HARDWARE/TEST CHANGES**19.3.1 MHS Rework – Electrodeposited Coating (NOAA-N)**

For NOAA-N, the contractor shall assist and support the MHS instrument vendor during the refurbishment and associated testing for the 23.8 GHz radiated emissions rework effort. The spacecraft contractor shall configure and operate the spacecraft, the MHS instrument and provide access to the area of rework. Special precautions shall be undertaken to ensure the health and safety of the spacecraft, subsystems and associated instruments during the application of the Electrodeposited coating.

19.3.2 MHS – AMSU-A1 Channel 8 Spur Investigation (NOAA-N)

For NOAA-N, the spacecraft contractor shall assist the instrument vendor's investigation of Channel 8 turn on spur, requiring the turn on of AMSU-A1 (s/n 109) for a least 2 hours or until phenomena is recorded. This investigation shall be performed after successful completion of 19.3.1 MHS Rework – Electrodeposited Coating.

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19.3.3 AVHRR DC/DC Converter Replacement

For NOAA-N and NOAA-N', the contractor shall assist and support the AVHRR instrument vendor during the replacement and instrument testing of the DC/DC converter. The spacecraft contractor shall configure and operate the spacecraft, the AVHRR instrument and provide access to the area of rework.

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19.3.4 MHS Rework - Electrodag Coating (NOAA-N')

For NOAA-N', the contractor shall assist and support the MHS instrument vendor during the refurbishment and associated testing for the 23.8 GHz radiated emissions rework effort. The spacecraft contractor shall configure and operate the spacecraft, the MHS instrument and provide access to the area of rework. Special precautions shall be undertaken to ensure the health and safety of the spacecraft, subsystems and associated instruments during the application of the Electrodag coating.

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